Series 1957, No. 20 Issued September 1964

SOIL SURVEY

Eastern Stanislaus Area California

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
CALIFORNIA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of the Eastern Stanislaus Area will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields. It also adds to our knowledge of soil science.

Locating the soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil on the map. Suppose, for example, an area located on the map has the symbol HdB. The legend for the detailed map shows that this symbol identifies Hanford sandy loam, 3 to 8 percent slopes. This soil and all others mapped in the county are described in table 2 in the section "Descriptions of the Mapping Units."

Finding information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Mapping Units," and then turn to the section "Use, Management, and Productivity of Soils." In this way they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units and Capability Units" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the Area, and the page where each is described. It also lists, for each soil and land type, the capability unit, and the pages where each unit is described.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Formation and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in the Area will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the Area," which gives additional information about the Area.

* * * * *

Fieldwork for the survey was completed in 1957. Unless otherwise indicated, all statements in the report refer to conditions in the Area at that time. The soil survey of the Area was made by the California Agricultural Experiment Station and the Soil Conservation Service and is part of the technical assistance furnished to the S.T. and J. and Salida Soil Conservation Districts.

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SOIL SURVEY OF THE EASTERN STANISLAUS AREA, CALIFORNIA

REPORT BY RODNEY J. ARKLEY, UNIVERSITY OF CALIFORNIA

SOILS SURVEYED BY RODNEY J. ARKLEY AND GALEN SMITH, UNIVERSITY OF CALIFORNIA; AND DONALD F. RAPPARLIE, HAL L. HILL, AND ALLAN POPE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THE EASTERN STANISLAUS AREA is in the east central part of the Great Valley of California (fig. 1). The main part of the Area is bounded on the north by the Stanislaus River, on the west by the San Joaquin River, on the south by the Merced County line, and on the east by the Tuolumne County line. Also included is a small triangular section at the northern tip of the county. This part of the Area is bounded on the west by the San Joaquin County line, on the northeast by the Calaveras County line, and on the south by the 38th parallel. The total extent of the Area is 475,546 acres; of this, 12 square miles, or 7,680 acres, are in the small triangle at the north.

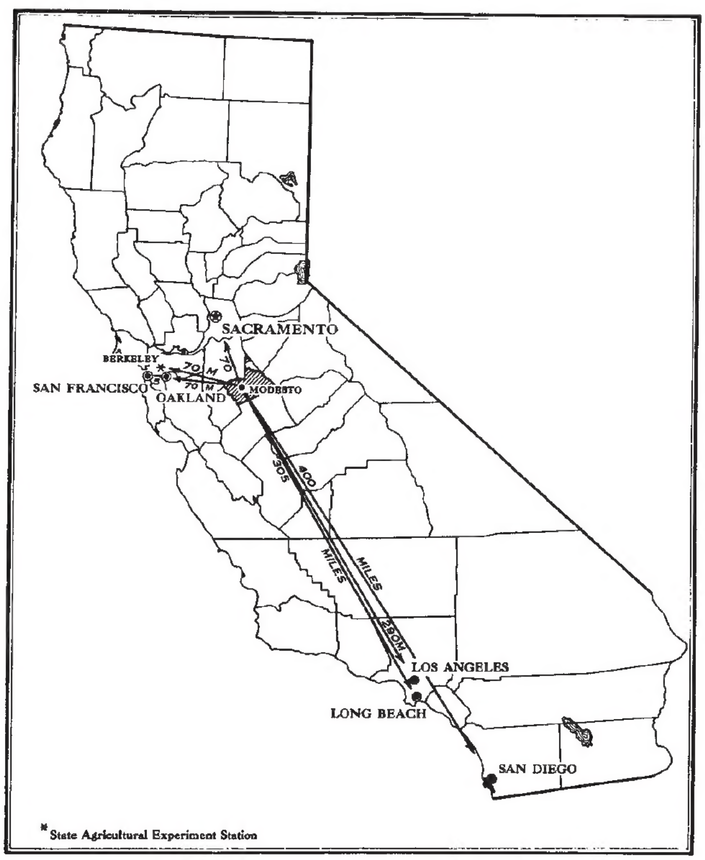

Figure 1.—Location of Eastern Stanislaus Area in California.

The part of Stanislaus County between the 38th parallel and the Stanislaus River is covered by the "Soil Survey of the Stockton Area, California"(*21*),[1] and the part of the county lying west of the San Joaquin River is covered by the "Soil Survey of the Newman Area, California" (*19*). A part of the Area was covered by an earlier soil survey in 1908 (*17*), and all of the Area except the northern triangle, or corner, was included in a reconnaissance soil survey made in 1915 (*18*).

Modesto, the fifth largest city in the San Joaquin Valley, is the county seat of Stanislaus County. It is located on the banks of the Tuolumne River. The Southern Pacific Railroad and U.S. Highway No. 99 go through this city.

The Area is drained by the San Joaquin River, and two large tributaries, the Tuolumne and the Stanislaus Rivers. These rivers rise near the crest of the Sierra Nevada, 90 miles to the east. Extending eastward from the San Joaquin River is a broad plain that rises from about 35 feet above sea level to about 175 feet in a distance of 15 to 20 miles. Along the eastern boundary, there is a narrow band of foothills of the Sierra Nevada. The elevation of these foothills ranges from 700 to 870 feet. Between the plain and the foothills are rolling hills. Some of these hills have nearly level tops, which are remnants of the surfaces of old alluvial fans.

The broad alluvial plains in the western part of the Area are irrigated for intensive production. Dairy farms with irrigated pastures and dryland grain farms occupy the central part of the Area. The hilly lands in the eastern and northern parts of the Area are used mainly for range pasture and beef cattle.

Why Soils Vary From Place to Place

The process of soil formation consists of the alteration of soil parent material (such as rock or sediments de-

[1] Italic numbers in parentheses refer to Literature Cited, p. 155.

posited by water or wind) by the forces of weather and living organisms. The resulting soils vary a great deal from place to place, depending upon the character of the parent material, the climate, the number and kind of living organisms, relief and drainage, and the length of time that soil-forming processes have been going on. At a given place, various forces act on the soil from the surface downward, so that layers, or horizons, are developed in the soil parent material. Thus soil properties vary vertically within one soil and laterally from one soil to another.

If a vertical section of soil is examined, as in a fresh road cut, it is possible to observe some of the variations in soil properties. The vertical column of soil is referred to as a soil profile. It can generally be subdivided into layers that are commonly called the surface soil, the subsoil, and the more or less unaltered parent material.

In this report the surface soil, if present, is called the *A horizon*, the subsoil the *B horizon*, and the soil parent material the *C horizon*. The designation Dr is used for unaltered hard, rock parent material. Unrelated material that underlies a soil is called a D layer. An example is the material over which an alluvial soil is deposited. Definitions of these and other terms used are given in the Glossary at the end of the report.

The surface soil, or A horizon, is generally enriched in humus or organic matter (the remains of dead plants or animals). It may, however, be more or less depleted of clay, lime, or soluble material because of the leaching action of rainwater. The subsoil, or B horizon, may be enriched in clay, lime, or other products of weathering that were leached from the surface soil. Many of the older soils of the Eastern Stanislaus Area have a very distinct B horizon. Some soils have a hardpan that was formed by the cementing action of silica, lime, or iron that was deposited in the Cm horizon immediately below a B horizon.

Lateral soil variation, as revealed in a long road cut or a series of road cuts, may be expressed in changes in depth, color, thickness, sequence of soil horizons, texture (the content of gravel, sand, silt, and clay), structural arrangement of soil aggregates, acidity or alkalinity, and many other features.

How Soils Are Named, Mapped, and Classified

Soil scientists made this survey to learn what kinds of soils are in the Eastern Stanislaus Area, where they are located, and how they can be used. They went into the Area knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the Area, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is usually named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Modesto and Pentz, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many soil series contain soils that are alike except for texture of their surface layer. According to this difference in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Modesto loam and Modesto clay loam are two soil types in the Modesto series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases. The name of a soil phase indicates a feature that affects management. For example, Amador loam, 0 to 8 percent slopes, is one of several phases of Amador loam, a soil type that ranges from nearly level to steep.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photos for their base map because these show woodlands, buildings, field borders, trees, and similar detail that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientist has a problem of delineating areas where different kinds of soils are so intricately mixed that it is not practical to show them separately on the map. Therefore, he shows this mixture of soils as one mapping unit and calls it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, for example, Peters-Pentz complex, 0 to 8 percent slopes. Also, in most mapping, there are areas to be shown that are so rocky, so shallow, or so frequently worked by wind and water that they cannot be called soils. These areas are shown on a soil map like other mapping units, but they are given a descriptive name, such as Riverwash, and are called land types rather than soils.

If two or more soils that normally do not occur in regular geographic association are so much alike in terms of use that separate mapping is impractical, the soils are mapped together as an undifferentiated mapping unit. The unit is named for soils in it. An example in the

Eastern Stanislaus Area is San Joaquin and Madera soils, 0 to 3 percent slopes.

Only part of the soil survey was done when the soil scientist had named and described the soil series and mapping units and had shown the location of the mapping units on the soil map. The mass of detailed information he had recorded then needed to be presented in different ways for different groups of users.

To do this efficiently, he had to consult with persons in other fields of work and jointly prepare with them groupings that would be of practical value to different users. Such groupings are soil profile groups, land type groups, and the capability classes, subclasses, and units. Storie index ratings and grades are also given.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows the main patterns of soils. Such a map is the colored general soil map in the back of this report. The general soil areas are also called soil associations. Each kind of general soil area, or association, as a rule contains a few major soils and several other minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ greatly among themselves in some properties; for example, slope, depth, stoniness, or natural drainage. Thus the general map does not show the kind of soil at any particular place, but a pattern that has in it several kinds of different soils.

The general soil areas are named for the major soil series in them, but as already noted, soils of other series may also be present. The major soil series of one general soil area may also be present in other areas, but in a pattern different enough to require a boundary.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

There are six distinct physiographic sections in the Eastern Stanislaus Area: (1) Recent alluvial flood plains; (2) Basin lands; (3) Young alluvial fans; (4) Low alluvial terraces and moderately old fans; (5) High alluvial terraces, partially eroded to rolling hills; and (6) Uplands of the Sierra Nevada foothills. The location of these physiographic sections is shown in figure 2. One or more soil associations are in each physiographic section. Each association consists of soils that formed from similar parent material and that have only minor differences in drainage and stage of profile development. Areas where erosion has exposed the sediments beneath high alluvial terraces are an exception. In these areas relatively young soils occur alongside old soils.

Soils of the Recent Alluvial Flood Plains

The flood plains of the major rivers, the San Joaquin, Tuolumne, and Stanislaus, are subject to flooding during periods of heavy rainfall or of rapid melting of snow in their watersheds. The large water-storage dams, built in recent years, have greatly reduced the frequency of flooding, but flood control is still not adequate to prevent occasional damage to crops. The water table often rises during periods of rapid runoff, even when there are no floods. Along the San Joaquin and the lower reaches of the Stanislaus and Tuolumne Rivers, the soils are generally mottled because of these wet periods.

The fresh alluvium added by each flood has retarded or prevented the formation of distinct soil horizons. Because of the rank growth of grasses, herbaceous plants, and willows, the soils are high in organic matter. Where the soils drain quickly, they are not mottled and they contain somewhat less organic matter.

The soils of the flood plains of the minor streams, such as Dry Creek, are subject to flooding for only a short time, and only local areas of these soils remain wet long enough to become mottled. The fresh alluvium is deposited at a slow rate, and some of the soils have weakly developed profiles.

The flood plains are nearly level except where they are cut by channels and oxbow depressions. A number of crops, such as alfalfa, irrigated pasture, truck crops, and orchard crops, are grown. Levee protection is provided in some areas.

1. Columbia-Temple association: Deep, imperfectly drained to poorly drained soils on the San Joaquin River flood plains

The soils of this association formed from alluvium derived from mixed, but mainly granitic, rock. The Columbia soils are close to the channels where alluvial deposition has been relatively rapid. Their soil profiles show no discernible horizons. These soils are grayish brown to light brown, mottled throughout, neutral to slightly acid, medium textured, and generally somewhat stratified. Large areas are underlain by dark soils at a depth of 1 to 4 feet. The Temple soils are in areas where deposition has been relatively slow. The surface soil is dark gray, neutral to mildly alkaline, moderately fine textured, and generally high in organic matter and fertility. The subsoil is gray but becomes olive gray and distinctly calcareous in the lower part.

In this association 927 acres of the Columbia soils and 1,946 acres of Temple soils were found to be slightly saline, and 114 acres of Columbia soils and 1,520 acres of Temple soils were found to be moderately saline.

The principal crops grown on the soils of this association are alfalfa, milo maize, and irrigated pasture.

2. Grangeville-Tujunga association: Deep, well-drained to imperfectly drained soils on the Stanislaus and Tuolumne River flood plains

The soils of this association formed from alluvium derived from granitic rock. The Grangeville soils resemble the Columbia soils, except that they are calcareous in the lower part and are affected by salts and alkali in places. A total of 986 acres of the Grangeville soils is slightly saline-alkali, and 109 acres is moderately saline-alkali. The Tujunga soils are light brownish-gray sands or loamy sands deposited by recent floods. They have a uniform profile. Crops grown on these soils are subject to drought if not irrigated frequently. The Hanford soils occur only on the areas of flood plains where floods and a high water table are of short duration. Floodwaters drain from these areas quickly after the rivers recede. The Hanford soils are light brown, moderately coarse-textured, and

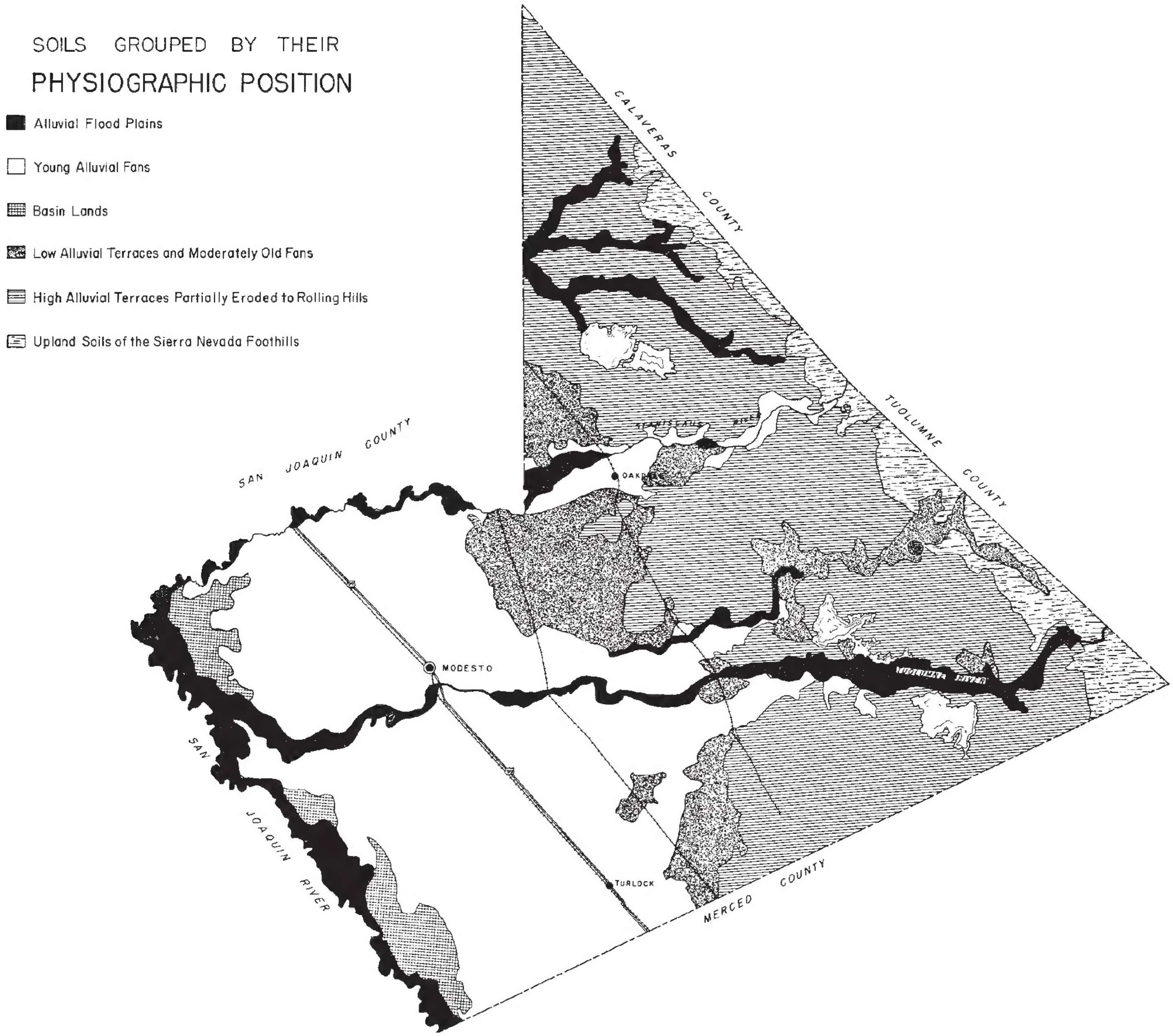

Figure 2.—**Soils grouped by their physiographic position.**

neither mottled nor calcareous. They have a uniform profile.

The main crops grown on the soils of this association are alfalfa, walnuts, tomatoes, and irrigated pasture (fig. 3).

3. Honcut-Wyman association: Deep, well-drained to moderately well drained soils on flood plains and low terraces of Dry Creek and other minor streams

The soils of this association are on the flood plains of minor streams and drainageways. All except the Anderson soils formed from alluvium derived mainly from basic igneous rock. The Anderson soils formed from mixed gravelly alluvium that was derived from soils nearby.

The Honcut and Wyman soils are along Dry Creek and its tributaries. They are brown, medium textured, well drained, and nearly neutral throughout. The Honcut soils occur where floods are frequent and deposition of alluvium is fairly rapid. Consequently, these soils have little or no profile development. The Wyman soils occur on slightly higher areas where deposition is very slow. These soils have slightly more clay in the subsoil than in the surface soil or the parent material.

The Bear Creek soils occur where subsurface drainage is impeded by a dense underlying layer of rock. These soils are nearly neutral, grayish-brown to dark-gray gravelly loams and clay loams. They have a clay loam

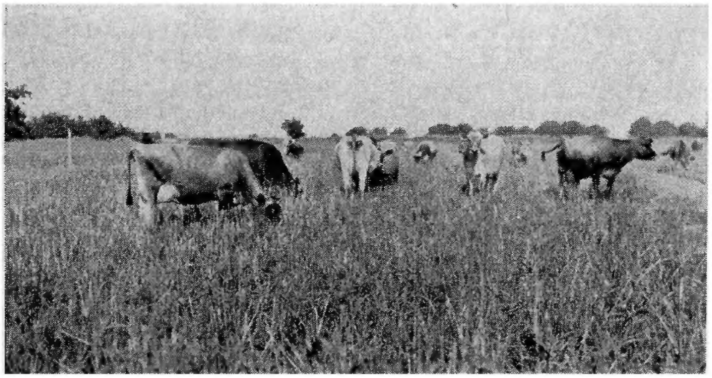

Figure 3.—**When irrigated, Grangeville soils of the alluvial flood plains produce a lush growth of grass for forage.**

subsoil. An unrelated substratum occurs at a depth of 3 to 5 feet.

Anderson soils are along minor narrow drainageways near Redding and Auburn soils. They consist of reddish-brown or brown, slightly acid, gravelly alluvium of variable texture. These soils have a uniform profile. Because they occur in such small bodies, they have little agricultural value except for pasture.

Honcut and Wyman soils are used for a wide range of field, orchard, and truck crops, but the Anderson soils are used for range pasture. Bear Creek soils are used mainly for irrigated pasture and rangeland, but some grain and truck crops are grown.

Soils of the Basin Lands

Basin lands are just east of the edge of the San Joaquin River flood plain. Surface drainage is slow, and the ground water level ranges from 1 to 4 feet below the surface. These areas comprise one soil association.

4. Waukena-Fresno association: Saline-alkali soils of the basin lands

The Waukena soils have a thin, light-gray fine sandy loam surface soil that rests abruptly on a dense, columnar, sandy clay loam subsoil. The subsoil is very slowly permeable and high in adsorbed sodium. The Fresno soils are similar, except that the structure of their subsoil is prismatic rather than columnar, and their subsoil is underlain at a depth of 2 to 3 feet by an impermeable hardpan that is cemented with lime and silica. Traver soils are also similar to the Waukena soils, except that their subsoil contains only slightly more clay and is moderately permeable. The Rossi soils are gray clay loams and clays and have a dense, slowly permeable, clay subsoil.

Of the 13,498 acres that were mapped in this association, 2,859 acres were slightly affected by salts and alkali, 8,047 moderately affected, and 2,592 strongly affected.

The soils of this association are used mainly for range pasture, but there is some irrigated pasture. They are not suitable for cultivated crops unless the undesirable saline-alkali conditions are corrected by such soil amendments as gypsum, by improved drainage, and by use of large quantities of irrigation water.

Soils of the Young Alluvial Fans

Broad, very gently sloping alluvial fans, made up of granitic alluvium, occupy an area about 12 miles wide, east of the San Joaquin River; narrow tongues extend eastward as low alluvial terraces along the rivers. The fans are 20 to 50 feet above the flood plains and are not subject to flooding or alluvial deposition. The soils of the young alluvial fans are generally well drained in the vicinity of Salida, Modesto, Ceres, and eastward but are generally imperfectly drained west of the Southern Pacific Railroad. Most areas are sandy loam and fine sandy loam, but a large area in the vicinity of Turlock, consists of wind-modified sand and loamy sand. The soils are generally fertile, and almost all are intensively cultivated. They produce a wide range of irrigated crops.

5. Hanford (Ripperdan)-Tujunga association: Deep, well-drained soils on alluvial fans of the Stanislaus and Tuolumne Rivers

The soils of this association are on the better drained parts of the young alluvial fans, where the water table is generally deeper than 6 feet. They show slight evidence of weathering and have a uniform profile.

The Hanford soils are light-brown or pale-brown sandy loams and fine sandy loams. They are deep, permeable, and uniform to a depth of 5 feet or more. In places the Hanford soils are underlain at a depth of 2 to 5 feet by layers of light-gray, compact silt and very fine sandy loam. These layers are less permeable than the soil above.

The Tujunga soils are sands and loamy sands. They occur as narrow bands through areas of Hanford soils. The Tujunga soils in this association differ from those in the Grangeville-Tujunga association mainly in that they are not subject to flooding.

Oakdale and Greenfield soils are only in small local areas. These soils are similar to the Hanford soils, but they have slightly more subsoil clay. In addition, the Oakdale soils are grayish brown or dark grayish brown and therefore darker than the Hanford. The profile development of the Oakdale and Greenfield soils and the darker color of the Oakdale soils are apparently caused by the slightly moister conditions that result from runoff from surrounding areas and from the somewhat restricted surface drainage.

Where ponding occurs, dark clay soils of the Meikle series have formed. These soils are described in the Paulsell association.

If irrigated, the soils of this association, except the Tujunga and Meikle, are among the most productive in California. They produce high yields of a wide range of orchard, vineyard, field, forage, and truck crops (fig. 4).

6. Hilmar-Delhi association: Deep, wind-modified, coarse-textured soils on alluvial fans of the Stanislaus and Tuolumne Rivers

The soils of this association occupy an area in the southern part of the county, south and west of Turlock. They have loamy sand and sand surface soils of low water-holding capacity. Crops grown on these soils are subject to drought unless frequently irrigated. The soils are subject to blowing if left exposed during the spring and fall.

The Delhi soils were formerly areas of dune sand that have been graded, and they now have gently undulating relief (fig. 5). They are pale-brown, neutral, excessively drained sands and loamy sands. They are uniform to a

Figure 4.—**Watermelons on Hanford sandy loam.**

Figure 5.—**Coarse Delhi soils in the vicinity of Turlock. These soils are subject to blowing if not protected by vegetation.**

depth of 5 to 10 feet. These soils contain a large percentage of unweathered minerals and provide a fair supply of the mineral nutrients (except zinc and sulfur) required by crops. Their organic-matter content is very low, and nitrogen must be supplied for nonlegumes. The main crops grown on these soils are alfalfa, almonds, grapes, and sweetpotatoes.

The Hilmar soils differ from the Delhi in that they are imperfectly drained, are calcareous in the lower part, and are underlain at 2 to 5 feet by compact silt, locally cemented with lime. The water table is generally at a depth of 2½ to 4 feet. Several large areas, totaling 2,481 acres, are slightly affected by salts and alkali. The main crops grown on these soils are alfalfa, silage corn, and irrigated pasture. Some grapes are also grown.

7. Dinuba-Hanford association: Moderately deep to deep, well-drained to imperfectly drained soils on fans of the Stanislaus and Tuolumne Rivers

This association is made up largely of Dinuba soils and streaks of the deeper Hanford soils. It is in a large area west of the Southern Pacific Railroad. This area extends eastward from the vicinity of Keyes to Denair. The deeper soils are mainly in old stream channels that have been filled with alluvium to the surrounding level or to a slightly greater height.

The Dinuba soils are grayish-brown sandy loams and fine sandy loams. They have a calcareous subsoil that rests on partially cemented calcareous beds of compact silts, similar to those underlying the Hanford and Hilmar soils. The Dinuba soils are imperfectly drained, and the depth to the water table varies between 3 and 6 feet. There are weak concentrations of salts and alkali in large areas that total 13,700 acres. The Dinuba soils differ from the Hanford soils because they have imperfect drainage.

Better drained areas of the soils in this association are used mainly for grapes, alfalfa, crops, and some orchards. Where the water table is nearer the surface, however, only field and forage crops are grown.

8. Modesto-Chualar association: Deep, slowly permeable soils in the flat area between the fans of the Stanislaus and Tuolumne Rivers

The soils of this association are on the outer margins of the Stanislaus River fan and between the fans of the Tuolumne and Stanislaus Rivers, north of Modesto. Surface drainage is somewhat restricted, and the depth to the water table ranges from 3 to 8 or more feet. Variable moisture conditions caused considerable variation in profile development. The Modesto and Chualar soils in this association have moderate amounts of subsoil clay, but the Dinuba soils have only a slight amount. Minor areas of all the soils described in the Hanford (Ripperdan)-Tujunga and Hilmar-Delhi associations are in this association.

The Modesto soils are grayish-brown loams and clay loams. They have a slowly permeable, blocky clay subsoil, generally calcareous in the lower part. The surface soil puddles easily, and it is generally difficult to manage under intensive cultivation. The Chualar soils are similar to the Modesto but are more workable sandy loams. Their subsoil is slightly more permeable and is only locally calcareous in the lower part. The Dinuba soils in this association are similar to those described for the Dinuba-Hanford association. A total of 1,477 acres of the Modesto soils and 406 acres of the Chualar soils are slightly affected by salts and alkali.

Crops grown on the soils of this association are about the same as those grown on soils of the Dinuba-Hanford association. Yields on the Modesto soils, however, are generally somewhat reduced because of the easily puddled surface soil, poor water penetration, and restricted aeration.

Soils of the Low Alluvial Terraces and Moderately Old Fans

Remnants of older fans of the Tuolumne and Stanislaus Rivers occur on gently undulating relief in the vicinity of Oakdale and east of Denair. They are made up of alluvium derived from granitic rocks. These areas are somewhat higher than the young alluvial fans previously described, and alluvial terraces at concordant elevations are traceable eastward along the rivers to the vicinity of Knights Ferry and La Grange (fig. 6). The soils on the fans have a distinct profile and a rocklike hardpan that is cemented with iron and silica. On the alluvial terraces to the east, the soils lack a hardpan; they have a sandy clay loam subsoil.

9. San Joaquin-Madera association: Hardpan soils on moderately old fans and terraces

The soils of this association have a hardpan that is cemented with iron and silica. The hardpan occurs at

Figure 6.—**A terrace sequence along Dry Creek; Ryer soil is on the horizon (left), Wyman on the horizon (center), and Honcut on the bottom land (center).**

a depth of 18 to 36 inches and is impermeable to roots and water. As a result, the soils are waterlogged in wet years, and crops are injured by drought in dry years. The San Joaquin soils are in the higher, better drained positions; the Madera soils are generally in slightly lower areas where runoff is slow; and the Alamo soils are in depressions without external drainage.

The San Joaquin soils are reddish-brown, slightly to medium acid loams and sandy loams. They have a thin clay subsoil, 1 to 5 inches thick, that rests abruptly on a cemented hardpan at a depth of 18 to 30 inches. The hardpan is 6 to 16 inches thick and overlies compact sandy loam. The Madera soils have a similar profile, except that they are brown, have a somewhat greater depth (24 to 36 inches) to the hardpan, and are neutral or mildly alkaline in the clay layer. The Alamo soils consist of gray or dark-gray clay, the clay resting abruptly on a hardpan at a depth of 14 to 30 inches. These soils crack deeply when dry, but they do not form the crumbly, granular surface structure of many dark clay soils.

In some areas, San Joaquin and Madera soils are so intermingled that they are not mapped separately. In depressions Madera and Alamo soils occur in an intricate pattern of mounds and depressions and are mapped as a complex.

The soils of this association are used mainly for irrigated pastures of ladino clover. A few unirrigated areas are used for dry-farmed grain.

10. Snelling association: Deep, well-drained, moderately permeable soils on moderately old fans and terraces

The soils of this association are on alluvial terraces that overlook the Stanislaus and Tuolumne Rivers. They formed from rather coarse sandy loam alluvium. The alluvium consists of channel deposits that are related to the fans on which the San Joaquin-Madera association occurs. Because the soil material is permeable, the soils lack a hardpan.

The Snelling soils consist of light grayish-brown or pale-brown, slightly acid, sandy loam that grades into a thick, brown, moderately permeable, sandy clay loam subsoil with massive structure. Friable sandy loam occurs at a depth of 4 to 5 feet.

These soils are used for a wide variety of irrigated crops, including almonds, grapes, alfalfa, and pasture. They are slightly less fertile, however, than the soils of the Hanford (Ripperdan)-Tujunga association.

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11. Ryer-Yokohl association: Deep, well-drained, slowly permeable or hardpan soils on moderately old terraces along Dry Creek

The soils of this association are near Warnerville on low terraces that overlook Dry Creek. They formed from silty alluvium derived mainly from schist (metamorphosed basic igneous rocks) and some mixture from slates (metamorphosed sedimentary rocks). They have more distinct horizons than the Honcut and Wyman soils on the flood plain and lower terraces farther downstream.

The Ryer soils are brown, slightly acid loams, clay loams, and clays. They have a neutral, reddish-brown, clay subsoil, which is slowly permeable and, in a few areas, calcareous in the lower part. The subsoil is underlain by brown loam or clay loam alluvium. The Yokohl soils are similar to the Ryer, except that they have a weakly to strongly cemented hardpan at a depth of 24 to 36 inches. They therefore closely resemble the Madera soils that formed from granitic alluvium.

The soils of this association are used mainly for irrigated pasture, dry-farmed small grain, and range pasture.

12. Paulsell association: Deep, clay soils on lacustrine deposits in Paulsell Valley

The Paulsell soils, the dominant soils in this association, developed from lacustrine deposits that were derived from basic igneous rocks. A lake was formed when Dry Creek was dammed by alluvial material that was deposited across the lower part of the valley by the Tuolumne River. This natural dam was formed when the Snelling soil material was deposited, and also when the Hanford-Tujunga soil material was deposited. Still later the lake was drained by Dry Creek, which has become entrenched in a steep-sided arroyo that extends eastward from Modesto to the county line.

Paulsell soils are dark-gray clays, which crack deeply and granulate on the surface when dry. Stratified fine sandy loam and clay loam sediments, similar to those of the Ryer-Yokohl association, underlie the clay. The surface soil is slightly acid, but the subsoil is neutral to mildly alkaline and intermittently calcareous in the lower part. There is little evidence of subsoil (B horizon) formation; layers below the surface layer, however, contain no more clay than the surface soil.

Areas of the Meikle soils occur in this association in small scattered spots east of Hickman. Like the Paulsell soils, these soils developed in ponded areas that were formed by a natural damming of local drainageways. The parent material of the Meikle soils, however, is alluvium from granitic rocks rather than from basic igneous rocks. The Meikle soils are similar to the Paulsell soils, but contain more sand. They are more difficult to manage under cultivation because they are hard when dry and are very sticky when wet. In addition, most areas still have no outlet for the water that accumulates in the ponded spots during the rainy season.

Soils of the High Alluvial Terraces, Partially Eroded to Rolling Hills

The eastern and northern parts of this physiographic section consist largely of rolling or conical hills but have

some scattered, nearly level remnants on old alluvial terraces and fans that are 150 to 600 feet above sea level (fig. 7).

In the older, level to gently undulating areas, the soils have a subsoil that consists of dense clay or is a hardpan. On the hillsides, however, the soils have a subsoil that shows little or no increase in clay content. The profile differences depend on the length of time the land surface has been exposed to weathering, and on erosion, which retards soil development.

13. Montpellier-Whitney association: Deep, slowly permeable soils on high terraces, and shallow to moderately deep soils on rolling, eroded terraces

The soils of this association formed from old granitic alluvium on high terraces and old fans in the areas east of Oakdale, Waterford, and Montpelier. They are mainly undulating to gently rolling. There is some erosion in cultivated areas that have slopes of more than 8 percent. Small bodies of Whitney and Rocklin soils occur within these areas.

The Montpellier soils consist of brown, slightly acid coarse sandy loam that rests abruptly at a depth of about 20 inches on a red or reddish-brown sandy clay loam subsoil. The subsoil is medium acid and 20 to 30 inches thick. Compact coarse sandy loam alluvium is at a depth of 3 to 6 feet. The Montpellier soils are related to the Snelling soils, but they have a more distinct subsoil.

The soils of this association are used mainly for dry-farmed grain in an alternate summer fallow rotation. Yields are only fair, and large farms are required for a profitable operation. Montpellier and Whitney soils are subject to erosion and, as a result, a few areas have been taken out of cultivation and used for range pasture. Where water is available, these soils are used for irrigated pasture. Sprinkler irrigation is used in areas of rolling topography.

14. Whitney-Rocklin association: Shallow to moderately deep hardpan soils on high terraces, and shallow to moderately deep soils on eroded terraces

The soils of this association are mainly east of Montpelier and Hickman; smaller areas are east of Waterford. The topography is undulating to steep. The Rocklin soils have gentle slopes of less than 8 percent; the Whitney soils have steeper slopes. On the slopes of 12 percent or less, however, the two soils frequently occur in patterns so intricately associated that they are mapped as an undifferentiated unit.

Figure 7.—**Landscape south of Knights Ferry showing high alluvial terraces. Keyes cobbly clay loam on the skyline; shallow Toomes soil and Lava and sandstone rockland of Tuolumne Table Mountain lava in the foreground.**

The Rocklin soils are reddish-brown sandy loams and fine sandy loams. They have a clay loam subsoil. The subsoil is underlain abruptly by weakly consolidated sediments capped with a hardpan, 1 to 3 inches thick. The hardpan is similar to that in the San Joaquin soils.

The Whitney soils formed from softly consolidated sediments of the same kind that underlies the Rocklin soils. Their surface soil is brown, reddish-brown, or grayish-brown, neutral sandy loam and fine sandy loam. The subsoil has slightly more clay. There is a gradual transition to soft consolidated sediments at a depth of 12 to 36 inches. On hillsides steeper than 12 percent, there are eroded spots where the substratum is exposed by plowing.

Like the soils in the Montpellier-Whitney association, these soils are used mainly for dry-farmed grain. Yields of grain are about the same.

The Whitney soils are more fertile than the Rocklin. They appear to have possibilities for growing quality grapes and other irrigated crops, but erosion control practices, such as contour planting and cultivation, should be used. Whitney soils also have a nearly frost-free climate because of the rolling topography.

15. Redding-Pentz-Peters association: Reddish, gravelly hardpan soils on high terraces, and shallow or clay soils on sloping terrace sides

The soils of this association are in the northeastern part of the Area. The Redding soils occur on gently sloping, elevated remnants of a broad gravelly fan that once mantled this part of the Area. The Pentz and Peters soils occur where erosion has stripped away much of the gravelly material and exposed the underlying andesitic tuff to weathering.

The Redding soils formed from gravelly material that contains a large proportion of hard quartzite and other metamorphosed gravel. These soils are yellowish-red, acid gravelly loams and cobbly loams. They have a red, gravelly clay subsoil that rests on a cemented conglomeratelike hardpan at a depth of 18 to 30 inches. Slopes are gentle, but they characteristically have a well-formed mound microrelief (*4*).

The Pentz soils occur mainly on rolling or hilly topography, but there are scattered areas with outcrops of hard tuff and gravel. These soils are shallow (4 to 14 inches deep), uniform grayish brown sandy loams, loams, gravelly loams, and clay loams.

The Peters soils occur on somewhat gentler slopes, particularly in places where they receive extra moisture from slopes above. These soils consist of dark-gray clay that contains gravel or cobbles in places. They are deeper than the Pentz soils (14 to 24 inches deep). They form deep cracks and granulate on the surface when they are dry.

The soils of this association are used mainly for range pasture; a few areas are in irrigated pasture and dry-farmed grain. The Redding soils are low in fertility; they are especially deficient in phosphorus. The Pentz and Peters soils are quite fertile. The Peters soils support a good cover of grass and burclover, which provides excellent forage for livestock during winter and spring. Because of shallowness and a low moisture-storage capacity, the Pentz soils dry out early in spring.

16. Keyes-Pentz-Peters association: Hardpan soils on high terraces, and shallow or clay soils on sloping terrace sides

This association differs only slightly from the Redding-Pentz-Peters association. The soils of the Keyes-Pentz-Peters association occur over wide areas east and southeast of Oakdale. The Keyes soils have formed where the gravelly mantle contains a large proportion of andesitic material. These soils are similar to Redding soils, but are grayish brown. The Pentz and Peters soil formed from andesitic tuff.

Also in this association are Raynor and Zaca soils. The Raynor soils are moderately deep, dark-gray clays and cobbly clays that formed from andesitic tuff. They are similar to the Peters soils but are deeper (24 to 42 inches deep) and contain some lime in the lower part of the profile. The Zaca soils occur in local spots on calcareous sediments of uncertain origin. They are granular, calcareous, black clays that crack deeply when dry. Zaca soils are 12 to 24 inches deep. They grade into soft, calcareous shale below this depth. These soils are used for range pasture, but grain has been grown occasionally.

17. Hopeton-Peters association: Shallow to moderately deep, medium- to fine-textured soils on lacustrine or mixed sediments

In the area between Waterford and Oakdale, there are deposits of andesitic tuff mixed with granitic sediments laid down under lacustrine conditions. This material contains beds of lightweight diatomaceous earth in places. The Hopeton and Peters soils have developed in these areas.

The Hopeton soils are brown or grayish-brown loams and clay loams. They have a clay subsoil that contains lime in the lower part. The Peters soils are described in the Redding-Pentz-Peters association.

The soils of this association are used mainly for irrigated pasture. The topography, however, is undulating, and water must be applied very slowly to avoid erosion.

Upland Soils of the Sierra Nevada Foothills

The foothills of the Sierra Nevada chain extend into the eastern part of the county for 1 to 4 miles. This is an area of rolling, hilly, and steep relief. It has a plant cover of grass and scattered blue oak. Rock outcrops and gravelly areas are common, and the soils are generally shallow because of natural erosion.

The soils in this section formed from three general kinds of rocks: hard metamorphic rocks, softer sedimentary rocks, and volcanic lava. The Auburn, Exchequer, and Whiterock soils formed from the metamorphic rocks (fig. 8); the Hornitos and Amador soils formed from the sedimentary rocks; and the Toomes soils formed from lava.

Nearly all of these upland soils are used for range pasture. The Zaca soils are the only upland soils used for dry-farmed grain. Some grain has been grown on areas of Auburn soils that are free of rock outcrops. Amador, Hornitos, and Toomes soils produce poor, scant forage, but the others produce good areas of pasture.

18. Auburn-Exchange association: Shallow or very shallow, rocky upland soils of moderate to low fertility

In this association the Auburn soils are undulating and gently rolling, and the Exchequer soils are mainly hilly and steep.

The Auburn soils are reddish brown loams and clay loams formed from metavolcanic schists, known as greenstone. They are shallow and have only faint horizon

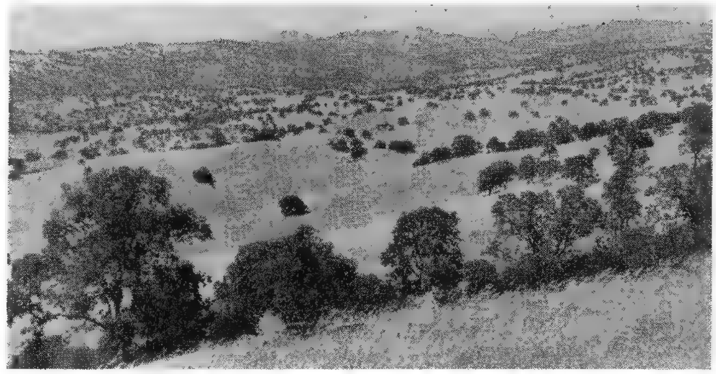

Figure 8.—**Shallow Exchequer, Auburn, and Whiterock soils on the hilly terrain of the Sierra Nevada foothills.**

distinction. The Exchequer soils are similar, but they are very shallow and have numerous rock outcrops.

Also in this association are Whiterock and Toomes soils. The Whiterock soils formed from slate and sandy slate. They are pale-brown silt loams that are very shallow and have numerous rock outcrops similar to those of the Exchequer soils. The Toomes soils are in the vicinity of Knights Ferry. They formed from the lava of Tuolumne Table Mountain. These soils are light brown, slightly to medium acid, and very shallow. They have numerous rock outcrops and areas of rocky scabland.

The soils of this association are all used for range pasture.

19. Hornitos-Amador association: Shallow or very shallow upland soils of very low fertility

The Hornitos soils formed from siliceous marine sandstone. They are shallow, medium acid, and infertile and have much gravel and many rock outcrops.

The Amador soils formed from rhyolitic tuff sediments. These soils are medium to strongly acid, pale brown, very shallow, and infertile.

Range pasture is the only use for the soils of this association.

20. Zaca association: Calcareous clay soils of the uplands

The only area of the Zaca association in Eastern Stanislaus County lies along the northeastern border within the area covered by the soil survey of the Stockton Area (*21*).

The Zaca soils formed on local spots from calcareous sediments of unknown origin. These soils consist of highly granular, calcareous, black clay. When dry, they crack deeply. They are 12 to 24 inches thick and grade into soft, calcareous shale.

21. Dredge and mine tailings: Gravelly and cobbly debris

This miscellaneous land type consists of areas of gravelly and cobbly debris. It has no agricultural value.

Soils of the Eastern Stanislaus Area

In this section the soil series and mapping units of the survey area are described. The soil series are described in the text, and the mapping units in table 2. The location and distribution of the mapping units are shown on the map in the back of this report. Their approximate acreage and proportionate extent are given in table 1.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alamo clay, 0 to 1 percent slopes	137	[1]
Amador gravelly loam, 0 to 8 percent slopes	1, 997	0. 4
Amador loam, 0 to 8 percent slopes	1, 388	. 3
Amador loam, 8 to 30 percent slopes	1, 735	. 4
Amador loam, 30 to 60 percent slopes	76	[1]
Anderson gravelly fine sandy loam, 0 to 3 percent slopes	615	. 1
Anderson gravelly fine sandy loam, 3 to 8 percent slopes	74	[1]
Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes	157	[1]
Auburn clay loam, 3 to 8 percent slopes	743	. 2
Auburn clay loam, 8 to 20 percent slopes	114	[1]
Bear Creek clay loam, 0 to 3 percent slopes	907	. 2
Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes	449	. 1
Bear Creek gravelly loam, 0 to 3 percent slopes	329	. 1
Bear Creek loam, 0 to 3 percent slopes	125	[1]
Chualar sandy loam, 0 to 3 percent slopes	1, 930	. 4
Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes	377	. 1
Columbia fine sandy loam, 0 to 1 percent slopes	1, 431	. 3
Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes	51	[1]
Columbia loam, 0 to 1 percent slopes	1, 241	. 3
Columbia silt loam, 0 to 1 percent slopes	1, 753	. 4
Columbia silt loam, slightly saline, 0 to 1 percent slopes	241	[1]
Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes	278	. 1
Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes	467	. 1
Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes	852	. 2
Columbia silty clay loam, slightly saline, 0 to 1 percent slopes	356	. 1
Columbia soils, 0 to 1 percent slopes	996	. 2
Columbia soils, channeled, 0 to 8 percent slopes	3, 560	. 7
Corning gravelly sandy loam, 3 to 8 percent slopes	281	. 1
Corning gravelly sandy loam, 8 to 15 percent slopes	370	. 1
Corning gravelly sandy loam, 15 to 30 percent slopes	612	. 1
Delhi loamy sand, 0 to 3 percent slopes	4, 847	1. 0
Delhi loamy sand, 3 to 8 percent slopes	312	. 1
Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes	344	. 1
Delhi loamy sand, silty substratum, 0 to 3 percent slopes	1, 652	. 3
Delhi sand, 0 to 3 percent slopes	1, 006	. 2
Delhi sand, 3 to 8 percent slopes	621	. 1
Dello loamy sand, 0 to 1 percent slopes	478	. 1
Dinuba fine sandy loam, 0 to 1 percent slopes	10, 069	2. 1
Dinuba fine sandy loam, shallow, 0 to 1 percent slopes	98	[1]
Dinuba fine sandy loam, deep, 0 to 1 percent slopes	761	. 2
Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	2, 317	. 5
Dinuba sandy loam, 0 to 1 percent slopes	27, 648	5. 8
Dinuba sandy loam, shallow, 0 to 1 percent slopes	640	. 1
Dinuba sandy loam, deep, 0 to 1 percent slopes	3, 371	. 7
Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes	157	[1]
Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes	14, 811	3. 1
Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes	376	. 1
Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes	977	. 2
Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes	208	[1]
Dredge and mine tailings	3, 196	. 7
Exchequer rocky loam, 30 to 60 percent slopes	138	[1]
Exchequer and Auburn rocky soils, 8 to 30 percent slopes	7, 233	1. 5
Exchequer and Auburn soils, 3 to 8 percent slopes	235	[1]
Exchequer and Auburn soils, 8 to 30 percent slopes	160	[1]
Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes	117	[1]
Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	194	[1]
Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	1, 003	. 2
Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	1, 458	. 3
Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes	1, 491	. 3
Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes	1, 505	. 3
Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes	24	[1]
Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes	817	. 2
Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes	61	[1]
Grangeville fine sandy loam, 0 to 1 percent slopes	1, 464	. 3
Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	161	[1]
Grangeville sandy loam, 0 to 1 percent slopes	222	[1]
Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes	311	. 1
Grangeville very fine sandy loam, 0 to 1 percent slopes	2, 942	. 6
Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	672	. 1
Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	219	[1]
Greenfield fine sandy loam, 0 to 3 percent slopes	299	. 1
Greenfield sandy loam, 0 to 3 percent slopes	3, 404	. 7
Greenfield sandy loam, 3 to 8 percent slopes	83	[1]
Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes	5, 460	1. 1
Hanford fine sandy loam, 0 to 3 percent slopes	5, 425	1. 1
Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes	361	. 1
Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes	5, 423	1. 1
Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes	4, 389	. 9
Hanford gravelly sandy loam, 0 to 3 percent slopes	160	[1]
Hanford sandy loam, 0 to 3 percent slopes	45, 860	9. 6
Hanford sandy loam, 3 to 8 percent slopes	900	. 2
Hanford sandy loam, 8 to 15 percent slopes	183	[1]
Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes	518	. 1
Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes	257	. 1
Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes	12, 998	2. 7
Hanford sandy loam, deep over silt, 0 to 1 percent slopes	4, 925	1. 0
Hanford very fine sandy loam, 0 to 1 percent slopes	743	. 2

[1] Less than 0.1 percent.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent
Hilmar loamy sand, 0 to 1 percent	13, 150	2. 8
Hilmar loamy sand, deep, 0 to 1 percent slopes	385	. 1
Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes	32	(1)
Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes	78	(1)
Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes	4, 173	. 9
Hilmar sand, 0 to 3 percent slopes	468	. 1
Honcut clay loam, 0 to 1 percent slopes	421	. 1
Honcut fine sandy loam, 0 to 1 percent slopes	208	(1)
Honcut loam, 0 to 1 percent slopes	768	. 2
Honcut sandy loam, 0 to 1 percent slopes	187	(1)
Hopeton clay, 3 to 8 persent slopes	140	(1)
Hopeton clay loam, 0 to 3 percent slopes	923	. 2
Hopeton clay loam, 3 to 8 percent slopes	1, 212	. 3
Hopeton loam, 0 to 3 percent slopes	579	. 1
Hopeton loam, 3 to 8 percent slopes	485	. 1
Hornitos fine sandy loam, 3 to 8 percent slopes	368	. 1
Hornitos fine sandy loam, 8 to 30 percent slopes	391	. 1
Hornitos gravelly fine sandy loam, 3 to 8 percent slopes	1, 512	. 3
Hornitos gravelly fine sandy loam, 8 to 30 percent slopes	2, 637	. 6
Keyes cobbly clay loam, 0 to 8 percent slopes	4, 227	. 9
Keyes gravelly clay loam, 0 to 8 percent slopes	1, 310	. 3
Lava and sandstone rockland	1, 031	. 2
Madera loam, 0 to 2 percent slopes	558	. 1
Madera sandy loam, 0 to 2 percent slopes	11, 295	2. 4
Madera sandy loam, 2 to 4 percent slopes	734	. 2
Madera-Alamo complex, 0 to 2 percent slopes	296	. 1
Meikle clay, 0 to 1 percent slopes	1, 444	. 3
Modesto clay loam, 0 to 1 percent slopes	1, 161	. 2
Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes	1, 031	. 2
Modesto loam, 0 to 1 percent slopes	3, 290	. 7
Modesto loam, slightly saline-alkali, 0 to 1 percent slopes	496	. 1
Montpellier coarse sandy loam, 0 to 3 percent slopes	4, 894	1. 0
Montpellier coarse sandy loam, 3 to 8 percent slopes	5, 728	1. 2
Montpellier coarse sandy loam, 8 to 15 percent slopes	2, 233	. 5
Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded	1, 397	. 3
Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded	3, 362	. 7
Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded	695	. 1
Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes	625	. 1
Oakdale sandy loam, 0 to 3 percent slopes	5, 888	1. 2
Paulsell clay, 0 to 1 percent slopes	3, 394	. 7
Pentz cobbly loam, very shallow, 0 to 8 percent slopes	24	(1)
Pentz cobbly loam, very shallow, 8 to 30 percent slopes	239	(1)
Pentz gravelly loam, 3 to 8 percent slopes	4, 546	1. 0
Pentz gravelly loam, 8 to 30 percent slopes	9, 295	2. 0
Pentz gravelly loam, 30 to 75 percent slopes	1, 790	. 4
Pentz loam, 3 to 8 percent slopes	577	. 1
Pentz loam, 8 to 30 percent slopes	1, 162	. 2
Pentz loam, 30 to 45 percent slopes	409	. 1
Pentz loam, moderately deep, 3 to 8 percent slopes	588	. 1
Pentz loam, moderately deep, 8 to 15 percent slopes	693	. 1
Pentz loam, moderately deep, 8 to 15 percent slopes, eroded	965	. 2
Pentz loam, moderately deep, 15 to 30 percent slopes	589	. 1
Pentz loam, moderately deep, 15 to 30 percent slopes, eroded	3, 440	. 7
Pentz sandy loam, 3 to 8 percent slopes	398	. 1
Pentz-Redding gravelly loams, 0 to 8 percent slopes	786	. 2
Peters clay, 0 to 8 percent slopes	4, 366	. 9
Peters clay, 8 to 15 percent slopes	561	. 1
Peters cobbly clay, 0 to 8 percent slopes	3, 504	. 7
Peters cobbly clay, 8 to 15 percent slopes	833	. 2
Peters-Pentz complex, 0 to 8 percent slopes	9, 261	1. 9
Peters-Pentz complex, 8 to 15 percent slopes	3, 006	. 6
Raynor clay, 0 to 3 percent slopes	2, 488	. 5
Raynor clay, 3 to 8 percent slopes	1, 882	. 4
Raynor clay, 8 to 15 percent slopes	36	(1)
Raynor cobbly clay, 0 to 8 percent slopes	3, 087	. 6
Raynor cobbly clay, 8 to 15 percent slopes	212	(1)
Redding cobbly loam, 0 to 8 percent slopes	488	. 1
Redding cobbly loam, 8 to 15 percent slopes	4	(1)
Redding gravelly loam, 0 to 8 percent slopes	2, 524	. 5
Rocklin sandy loam, 0 to 3 percent slopes	1, 609	. 3
Rocklin sandy loam, 3 to 8 percent slopes	1, 846	. 4
Rossi clay, moderately saline-alkali, 0 to 1 percent slopes	373	. 1
Rossi clay, strongly saline-alkali, 0 to 1 percent slopes	88	(1)
Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes	640	. 1
Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes	360	. 1
Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes	70	(1)
Riverwash	1, 532	. 3
Ryer clay, 0 to 1 percent slopes	949	. 2
Ryer clay loam, 0 to 1 percent slopes	545	. 1
Ryer loam, 0 to 1 percent slopes	1, 345	. 3
San Joaquin sandy loams, 0 to 3 percent slopes	17, 559	3. 7
San Joaquin sandy loams, 3 to 8 percent slopes	1, 362	. 3
Schist rockland	585	. 1
San Joaquin and Madera soils, 0 to 3 percent slopes	796	. 2
Snelling sandy loam, 0 to 3 percent slopes	5, 787	1. 2
Snelling sandy loam, 3 to 8 percent slopes	1, 998	. 4
Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes	117	(1)
Temple loam, overwashed, 0 to 1 percent slopes	285	. 1
Temple loam, overwashed, slightly saline, 0 to 1 percent slopes	1, 430	. 3
Temple loam, overwashed, moderately saline, 0 to 1 percent slopes	279	. 1
Temple silty clay, slightly saline, 0 to 1 percent slopes	278	. 1
Temple silty clay, moderately saline, 0 to 1 percent slopes	170	(1)
Temple silty clay loam, 0 to 1 percent slopes	168	(1)
Temple silty clay loam, slightly saline, 0 to 1 percent slopes	546	. 1
Temple silty clay loam, moderately saline, 0 to 1 percent slopes	1, 039	. 2
Toomes rocky loam, 0 to 8 percent slopes	155	(1) . 2
Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	8	(1)
Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	102	(1)
Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	144	(1)
Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes	629	. 1
Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes	279	. 1

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Percent
Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes	35	[1]
Tuff rockland	113	[1]
Tujunga loamy sand, 0 to 3 percent slopes	18, 578	3. 9
Tujunga loamy sand, 3 to 5 percent slopes	329	. 1
Tujunga sand, 0 to 3 percent slopes	1, 339	. 3
Terrace escarpments	3, 841	. 8
Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	673	. 1
Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	4, 636	1. 0
Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	928	. 2
Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes	461	. 1
Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes	143	[1]
Whiterock rocky silt loam, 8 to 30 percent slopes	857	. 2
Whiterock rocky silt loam, 30 to 60 percent slopes	246	. 1
Whiterock silt loam, 0 to 8 percent slopes	780	. 2
Whitney sandy loams, 3 to 8 percent slopes	4, 404	. 9
Whitney sandy loams, 8 to 15 percent slopes	4, 197	. 9
Whitney sandy loams, 8 to 15 percent slopes, eroded	3, 413	. 7
Whitney sandy loams, 15 to 30 percent slopes	2, 717	. 6
Whitney sandy loams, 15 to 30 percent slopes, eroded	6, 677	1. 4
Whitney sandy loams, 30 to 45 percent slopes, eroded	489	. 1
Whitney and Rocklin sandy loams, 0 to 3 percent slopes	847	. 2
Whitney and Rocklin sandy loams, 3 to 8 percent slopes	11, 235	2. 4
Whitney and Rocklin sandy loams, 8 to 15 percent slopes	1, 993	. 4
Wyman clay loam, 0 to 1 percent slopes	308	. 1
Wyman loam, 0 to 1 percent slopes	623	. 1
Wyman loam, moderately deep over gravel, 0 to 1 percent slopes	522	. 1
Yokohl loam, 0 to 1 percent slopes	1, 670	. 3
Yokohl clay loam, 0 to 3 percent slopes	37	[1]
Zaca clay, 3 to 8 percent slopes	125	[1]
Zaca clay, 8 to 15 percent slopes	147	[1]
Zaca clay, 15 to 30 percent slopes	71	[1]
Intermittent water	1, 419	. 3
Water	8, 162	1. 7
Made land	36	[1]
Mines and pits	117	[1]
Total area mapped	475, 546	100. 0

[1] Less than 0.1 percent.

Soil Series and Miscellaneous Land Types

In this section the soil series and miscellaneous land types in the Area are described. Following these descriptions, the mapping units are described in table 2.

Alamo series

The Alamo series is made up of poorly drained, fine-textured soils that have a hardpan. These soils developed from old alluvial-fan material weathered mainly from granitic rocks. They are in small depressed areas that have very slow to ponded runoff. They are under grass-forb vegetation.

The surface soil is characteristically dark-gray, slightly acid clay with very coarse blocky (adobe) structure. A brown, reddish-brown, or pale-brown hardpan, cemented with iron-silica, is at a depth of 14 to 30 inches. The parent material is sandy alluvium that contains quartz and partially weathered feldspar and mica.

The Alamo soils are in the vicinity of Denair, Hickman, and Oakdale. They are associated with the San Joaquin and Madera soils, which have mound or hog-wallow microrelief. In a few places the Alamo soils form a complex with these soils. The dark color and clay texture of the Alamo soils contrast strongly with the brown or reddish-brown sandy loam of the surrounding soils.

The Alamo soils are at elevations of 100 to 200 feet in a subhumid climate that has a mean annual precipitation of 12 to 14 inches. The average frost-free period is about 300 days.

These soils are used mainly for dry-farmed grain and irrigated pasture.

Amador series

The Amador series consists of well-drained to excessively drained, medium-textured soils developed from rhyolitic (acid igneous) tuff. These soils are on gently sloping to steep relief that has pronounced mound microrelief. They are under annual grass-forb vegetation.

These soils are characteristically shallow to very shallow, light yellowish brown to very pale brown, and very strongly acid. The parent material is weakly to strongly cemented clay rock.

These soils are along the eastern edge of Stanislaus County. They are associated with the Hornitos, Pentz, and Exchequer soils.

Amador soils are at elevations of 300 to 500 feet in a subhumid climate that has a mean annual precipitation of 15 to 18 inches. The average frost-free period is 250 to 300 days.

Amador soils are of low agricultural value. They are used only for range, and they produce meager quantities of low-quality forage.

Anderson series

The soils of the Anderson series are well drained, gravelly, and moderately coarse textured. They formed from recent gravelly alluvium deposited by local streams. These streams drain areas of metamorphosed basic igneous rock, andesitic tuff, and old fans occupied by gravelly soils, such as Redding, Corning, and Keyes. They are on gently sloping, narrow bottom lands cut by one or several shallow stream channels. The vegetation consists of grasses and forbs.

These soils are characteristically brown to reddish-brown, slightly to medium acid, stratified gravelly fine sandy loams or gravelly sandy loams underlain by loose gravelly alluvium.

Anderson soils are in small, narrow bottom lands in the area east of Oakdale. They are associated with the Bear Creek, Honcut, and Wyman soils.

Anderson soils are at elevations of 150 to 350 feet in a subhumid climate that has a mean annual precipitation

of 14 to 16 inches. The average frost-free period is about 250 days.

These soils are of little agricultural importance. They are used only for range pasture.

Auburn series

The soils of the Auburn series are gently sloping to hilly, well drained to somewhat excessively drained, moderately fine textured, and shallow to moderately deep. They developed from basic rocks. The vegetation consists of annual grasses, forbs, and scattered oak.

The surface soil is brown, moderately fine textured, and slightly acid. The reddish-brown, moderately fine textured, slightly acid subsoil is underlain by the hard parent rock. This rock, locally called greenstone, is amphibolite schist and diabase.

These soils are in the lower western foothills of the Sierra Nevada chain. They are in the same general area as the Exchequer and Whiterock soils.

Auburn soils are at elevations of 300 to 1,000 feet in a subhumid climate that has a mean annual precipitation of 15 to 25 inches. The frost-free season is about 300 days.

Auburn soils are used mainly for grazing of livestock.

Bear Creek series

The Bear Creek series consists of moderately well drained, medium to moderately fine textured soils. These soils are along very gently sloping, narrow drainageways of minor streams. The vegetation consists of grasses and small herbaceous plants.

The surface soil is characteristically dark, slightly acid loam or clay loam. The subsoil is sandy clay. The parent material is gravelly, medium-textured alluvium derived from a variety of valley-filling materials, mainly andesitic tuff. These soils are underlain at about 4 feet by an unrelated hard substratum.

These soils are in several minor drainageways east of Oakdale. They are associated with the Anderson and Paulsell soils and are in the same general area as the Pentz, Peters, Keyes, and Redding soils.

Bear Creek soils are at elevations of 100 to 350 feet in a climate that has a mean annual precipitation of 14 to 16 inches. The frost-free period is about 250 days.

These soils are used for range pasture and to some extent for irrigated pasture.

Chualar series

The soils of the Chualar series are moderately well drained and moderately coarse textured. They developed from alluvium weathered mainly from granitic rocks. They are on smooth, very gently sloping to nearly level relief. The vegetation consists of annual grasses and small herbaceous plants.

The surface soil is characteristically grayish-brown, slightly acid to neutral sandy loam. The subsoil is brown, neutral to mildly alkaline clay loam that is faintly mottled. In places it is slightly calcareous in the lower part. The underlying material is soft, faintly mottled sandy loam. The parent material is porous sandy loam or coarse sandy loam that contains unweathered quartz, feldspar, and mica.

Many areas of these soils are in the vicinity of Modesto. They are associated with the Oakdale, Dinuba, and Modesto soils.

The Chualar soils are at elevations of 50 to 150 feet in a subhumid climate that has a mean annual precipitation of 10 to 13 inches. The frost-free period is about 300 days.

These soils are important for growing a wide variety of orchard, vineyard, field, and forage crops. Yields are good to excellent.

Columbia series

The Columbia series consists of imperfectly drained, moderately coarse to moderately fine textured alluvial soils. These soils developed from alluvium weathered from a variety of rocks. In this area the alluvium had a considerable proportion of granitic material. The Columbia soils have nearly level, somewhat channeled relief. They are subject to a high water table or to flooding early in summer. The vegetation is dense and consists of grasses, forbs, and trees.

These soils are characteristically pale brown or light yellowish brown to grayish brown and nearly neutral throughout. Strong-brown mottles are visible at or near the surface and increase in prominence with depth. In places these soils are stratified with dark-colored layers and sand.

Columbia soils are mainly along the San Joaquin River. In this area they are associated with the Temple soils.

Columbia soils are at elevations of 30 to 60 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The frost-free season is about 250 days.

In this area the Columbia soils are important in the production of alfalfa and field crops.

Corning series

The soils of the Corning series are well drained, gravelly, and moderately coarse textured. They have a subsoil of dense sandy clay. They are in areas of undulating to hilly relief that have some mound microrelief. The vegetation consists of annual grasses and forbs.

The surface soil is brown to reddish-brown gravelly sandy loam, and the subsoil is yellowish-red sandy clay that is slightly acid. The parent material is gravelly sandy loam alluvium that weathered from various rocks. The gravel is generally very hard.

Corning soils are in the area southwest of La Grange. They are associated with the Redding and Montpellier series.

The soils of this series are at elevations of 200 to 300 feet in a subhumid climate that has a mean annual precipitation of 14 to 16 inches. The average frost-free period is about 300 days.

Corning soils are used mostly for range and to some extent for dry-farmed grain.

Delhi series

The Delhi series consists of somewhat excessively to excessively drained, coarse-textured soils. These soils developed from sand reworked from granitic alluvium by wind. They are on gently undulating and, in places, slightly hummocky relief. They are under an annual vegetation of grasses and forbs.

The Delhi soils are characteristically uniform throughout. They consist of light brownish-gray to pale-brown, neutral, loose, very rapidly permeable sand or loamy sand.

The parent material is cross-bedded, well-sorted sand that contains quartz, feldspar, mica, and hornblende.

These soils are in the vicinity of Turlock and in scattered areas just south of the Stanislaus and Tuolumne River bottom lands. They are associated with the Dinuba and Hilmar soils.

The Delhi soils are at elevations of 50 to 100 feet in a subhumid climate that has a mean annual precipitation of 10 to 13 inches. The frost-free period is about 300 days.

These soils are important for growing melons, alfalfa, sweetpotatoes, almonds, peaches, and grapes.

Dello series

The soils of the Dello series are imperfectly to very poorly drained and coarse textured. They developed in blowouts and depressions in areas of Delhi soils, which consist of wind-laid, granitic sand.

The surface soil and subsoil are mottled bluish-gray, neutral to strongly alkaline loamy sand. The subsoil is underlain by mottled light-gray sand at a depth of 5 feet or more. The water table is generally within 3 feet of the surface.

The Dello soils are at elevations of 50 to 100 feet in a subhumid climate that has a mean annual precipitation of 10 to 13 inches. The frost-free period is about 300 days.

These soils are too wet for cultivated crops. They are used mainly for pasture.

Dinuba series

The soils of the Dinuba series are imperfectly drained and moderately coarse textured. They developed from alluvium derived from granitic rock. They are on young alluvial fans and have very gently sloping to nearly level, smooth relief. These soils are affected by salts and alkali in places. In areas that are not cultivated, the vegetation consists of annual grasses, herbaceous plants, and in some places, saltgrass, spikeweed, and other salt-tolerant plants.

The surface soil is characteristically grayish-brown sandy loam. The subsoil is of the same texture but is mottled and intermittently slightly calcareous. The parent material is sandy loam that is underlain at various depths by strata of compact silt and very fine sand. It is underlain by an unrelated silty substratum that is partially cemented with lime in places.

These soils are associated with the Hanford, Hilmar, and Fresno soils.

Dinuba soils are at elevations of 50 to 150 feet in a semiarid climate that has a mean annual precipitation of 10 to 12 inches. The frost-free period is 250 to 300 days.

These soils are largely cultivated. They are used mainly for irrigated pasture, grain, and vine crops.

Dredge and mine tailings

This miscellaneous land type consists of cobbly and gravelly debris left behind by gold dredging that was formerly carried on in the county. It covers large areas along the Stanislaus and Tuolumne Rivers. It contains numerous stagnant ponds that provide breeding places for mosquitoes and that are unsightly and unsanitary. The areas of this land type have little or no grazing value.

Exchequer series

The soils of the Exchequer series are well drained to somewhat excessively drained, shallow and very shallow, medium textured, and gently rolling to steep. They developed from metamorphosed basic igneous rocks. They are under an annual grass-forb vegetation and scattered blue oak.

These soils consist of reddish-brown, slightly acid rocky loam. The parent material is meta-andesite (greenstone) or amphibolite schist with bedding planes that are nearly vertical.

These soils are along the eastern boundary of Stanislaus County. They are intricately associated with the Auburn and Whiterock soils.

Exchequer soils are at elevations of 300 to 1,000 feet in a subhumid climate that has a mean annual precipitation of 15 to 25 inches. The frost-free period is about 300 days.

These soils are important only for range pasture.

Foster series

In this series are very poorly drained soils that have formed in recently deposited granitic alluvium. In this area these soils are in small depressions and oxbows on bottom lands. They are subject to occasional flooding and to a fluctuating high water table. They support a growth of bermudagrass, sedges, and willows.

These soils are dark grayish-brown very fine sandy loam, mottled with gray, yellowish brown, and strong brown (rust color) at or near the surface and throughout the profile. The wettest spots are also mottled with bluish gray. In places the soil material is stratified with sandy layers. These soils are generally calcareous and contain salt and alkali in places.

Only one Foster soil is mapped in the Eastern Stanislaus Area. It is on the bottom lands of the Stanislaus and Tuolumne Rivers in small areas of 3 to 10 acres. Some of the depressions occupied by this soil impede farming operations but can be filled in places by leveling equipment. These converted areas would then be similar to areas of Grangeville soils.

Foster soils are used only for pasture or are left idle.

Fresno series

The Fresno series consists of moderately coarse textured, imperfectly drained, saline-alkali soils with hardpans. These soils developed on alluvium derived mainly from granitic rocks. They are on nearly level valley plains that have distinct mound microrelief in places.

The surface soil is characteristically light brownish-gray sandy loam or fine sandy loam. It is generally neutral, but spots are mildly to strongly alkaline. Below about 5 inches, the reaction is usually between pH 9.0 and 10.0. The subsoil is prismatic and blocky sandy clay loam that rests on a lime-silica cemented hardpan. The parent material is micaceous, medium-textured alluvium that contains variable amounts of salts and alkali.

These soils are in a narrow band east of the San Joaquin River flood plain. They are associated with the Traver and Waukena soils and in places with the Dinuba soils.

The Fresno soils are at elevations of 40 to 60 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The frost-free period is about 250 days.

These soils are used mainly for dryland pasture; some areas are used for irrigated pasture that produces only fair to poor forage.

Grangeville series

The Grangeville series is made up of imperfectly drained, medium and moderately coarse textured soils. These soils developed from recently deposited alluvium derived mainly from granitic rocks and some metamorphic rocks. They are in areas having nearly level relief, but there are some channels and oxbow depressions. They are under grass-woodland vegetation.

The Grangeville soils are characteristically grayish-brown sandy loam to very fine sandy loam. The subsoil is mottled rust brown, is stratified, and contains lime at variable depths. The parent material is stratified alluvium that contains large amounts of mica, feldspar, and quartz. It is generally fine sandy loam to silt loam.

These soils are along the bottom lands and on the lower fans of the Stanislaus and Tuolumne Rivers. They are associated with the Hanford, Tujunga, and Foster soils.

The Grangeville soils are at elevations of 40 to 100 feet in a subhumid climate that has a mean annual precipitation of 10 to 15 inches. The average frost-free period is about 250 days.

These soils are used for walnuts, tomatoes and other truck crops, alfalfa, and irrigated pasture.

Greenfield series

The soils of the Greenfield series are well drained and moderately coarse textured. They developed from alluvium derived from granitic rocks. They are on nearly level to gently sloping, low alluvial terraces. The vegetation consists of grasses, forbs, and scattered oaks.

These soils are characteristically light brownish-gray sandy loam that is neutral to slightly acid. The subsoil is brown and has slightly more clay than the surface soil. The parent material is generally sandy alluvium that contains angular quartz sand, fresh feldspar, and mica.

These soils are on benches along the Tuolumne River and along Dry Creek West of Hazel Dean Avenue. They are associated with the Hanford and Snelling soils.

The Greenfield soils are at elevations of 100 to 250 feet in a subhumid climate that has a mean annual precipitation of 12 to 14 inches. The frost-free period is 250 to 300 days.

These soils are used for orchards, vineyards, and field crops.

Hanford series[2]

The Hanford series consists of well-drained, moderately coarse textured soils. These soils developed from alluvium derived from granitic rocks. They have smooth, very gentle slopes and are on broad, young and recent alluvial fans and alluvial terraces. They are under annual grass-forb vegetation and scattered oaks.

These soils are characteristically pale brown or light brownish gray when dry, deep and uniform throughout, and neutral or slightly acid. The parent material is sandy loam that contains a large proportion of fresh minerals.

The Hanford soils are along the Stanislaus and Tuolumne Rivers and on broad fans in the vicinity of Salida, Modesto, Hughson, Ceres, and Empire. They are associated with the Tujunga, Grangeville, and Dinuba soils.

These soils are at elevations of 40 to 150 feet in a subhumid climate that has a mean annual precipitation of 10 to 14 inches. The average frost-free period is 250 to 300 days.

These are important soils for the production of a wide variety of irrigated orchard, field, and truck crops.

Hilmar series

The soils of the Hilmar series are coarse textured and imperfectly to very poorly drained. They developed from wind-worked sands derived from granitic alluvium. They are for the most part gently undulating but in places are slightly hummocky. The vegetation consists of grasses and forbs.

The Hilmar soils are characteristically light brownish-gray or pale-brown sand or loamy sand. The subsoil is faintly mottled below 12 inches, and it becomes more mottled and somewhat calcareous with depth. The subsoil is underlain abruptly by a layer of compact silt loam that is somewhat cemented with lime in the upper part. The parent material is sand or loamy sand made up of quartz, feldspar, hornblende, and mica, which are found in granitic rocks.

These soils are mainly in the area southwest and west of Turlock. They are associated with the Delhi and Dinuba soils.

The Hilmar soils are at elevations of 50 to 120 feet in a semiarid climate that has a mean annual precipitation of 8 to 12 inches. The average frost-free period is 300 days.

These soils are used for field and forage crops. Some grapes are grown. Orchards have been planted in some areas but generally are not suited to the high water table and the calcareous and alkaline subsoil.

Honcut series

The Honcut series is made up of well-drained, moderately coarse to moderately fine textured soils. These soils developed from alluvium derived mainly from basic igneous and metamorphic rocks. They occur on smooth, nearly level fans and bottom lands under a grass-oak vegetation.

The Honcut soils are characteristically brown and nearly neutral throughout. The parent material is slightly stratified alluvium that is high in feldspar and ferromagnesian minerals and low in quartz.

These soils are along Dry Creek. They are associated with the Wyman, Ryer, and Yokohl soils, which developed from similar material, and the Anderson soils, which developed from gravelly alluvium.

The Honcut soils are at elevations of 100 to 250 feet in a subhumid climate that has a mean annual precipitation of 12 to 18 inches. The frost-free period is about 250 days.

These soils are used for a wide variety of orchard, truck, field, and forage crops.

Hopeton series

The Hopeton series is made up of well-drained, medium- to fine-textured soils. These soils developed from mixed sediments derived mainly from basic igneous rocks. They occur on gently sloping to undulating relief under an annual grass-forb vegetation that includes annual legumes.

The Hopeton soils are characteristically dark gray to dark brown. They are slightly acid in the surface soil

[2] This series includes soils described under the name "Ripperdan" in University of California Soil Survey Report No. 13, Soils of Eastern Stanislaus County, California (3), and in some other University of California publications.

and become mildly alkaline with depth. They have a clay subsoil. These soils are very slightly calcareous below the subsoil. The parent material is weakly consolidated sandstone that has a high content of weatherable minerals.

These soils are in small areas east of Hickman, Waterford, and Oakdale. They are associated with the Redding, Corning, Pentz, Peters, and Raynor soils, and in places with the Whitney soils.

The Hopeton soils are at elevations of 200 to 400 feet in a subhumid climate that has a mean annual precipitation of 12 to 15 inches. The frost-free period is 250 to 300 days.

These soils are used for dry-farmed grain and irrigated pasture.

Hornitos series

The Hornitos series consists of well to somewhat excessively drained, moderately coarse textured, shallow and very shallow soils. These soils developed from siliceous marine sandstone of the Ione formation. They occur on gently undulating to hilly relief under annual grass-forb vegetation and scattered blue oaks. Mound microrelief is well developed on the gentler slopes.

The Hornitos soils characteristically vary in color, depending upon the color of the parent material. They are sandy loam or fine sandy loam with varying amounts of gravel and are slightly to strongly acid. Depth ranges from 3 to about 14 inches. The parent material consists of sandstone, mainly quartz, but also kaolin and secondary minerals, interbedded with conglomerate and kaolinitic clay. The color ranges from pink to reddish yellow or white.

These soils are along the edge of the Sierra Nevada foothills on the eastern edge of Stanislaus County. They are associated with the Exchequer, Auburn, Whiterock, and Amador soils.

The Hornitos soils are at elevations of 250 feet in a subhumid climate that has a mean annual precipitation of 15 to 18 inches. The frost-free period is 250 to 300 days.

These soils are used only for range pasture.

Keyes series

The Keyes series is made up of well-drained, gravelly or cobbly, moderately fine textured soils with hardpans. These soils developed from andesitic (basic igneous) gravel. They have gentle slopes with distinct mound microrelief. They occur on old, partially dissected, high alluvial terraces and fans under grass-forb vegetation.

Characteristically these soils have a grayish-brown, cobbly or gravelly clay loam surface soil. They have a clay subsoil that rests directly on an indurated, iron-silica hardpan at about 15 inches. The hardpan is generally about 12 inches thick. It is underlain by gravelly sandy loam that is very weakly consolidated in places. The parent material is loose to very weakly consolidated gravel deposited in the valley.

These soils are in the area that extends east of Oakdale to near Knight's Ferry. They are associated with the Pentz, Peters, and Raynor soils that formed from less gravelly, andesitic sediments, and with the Redding and Corning soils that formed from more siliceous gravel.

Keyes soils are at elevations of 300 to 600 feet in a climate that has a mean annual precipitation of 13 to 16 inches. The frost-free period is about 300 days. These soils are used mainly for range pasture and dry-farmed small grain.

Lava and sandstone rockland

This miscellaneous land type consists of lava rockland and sandstone rockland. Lava rockland is a blocky jumble of lava. It is in only one area southeast of Knight's Ferry. It is associated with the Toomes soil. Except for a very little grazing, it has little or no agricultural value. Sandstone rockland is a blocky jumble of sandstone that has only a little soil material in the cracks. It is associated with Hornitos soils, is of little or no agricultural value, and in places is quarried for building stone.

Madera series

The Madera series is made up of well-drained, medium and moderately coarse textured soils with hardpans. These soils developed from moderately coarse textured alluvium derived mainly from granitic rocks. They are on gently undulating old fans that have mound microrelief in unleveled areas. The vegetation consists of annual grasses and forbs.

The surface soil is characteristically brown, neutral sandy loam or loam. The subsoil is brown to reddish-brown sandy clay. It is underlain at a depth of 24 to 42 inches by an indurated iron-and-silica hardpan that contains seams of lime. Generally the underlying material is stratified sandy loam that is compact and weakly cemented in places.

These soils are in the area between Modesto and Riverbank and in the vicinity of Hickman and Denair. They are associated with the San Joaquin, Alamo, and Snelling soils.

In places the Madera and San Joaquin soils are intimately associated with these soils, or so similar in agricultural use, that no attempt has been made to differentiate them. Where the Madera soils occur as distinct bodies, however, they are mapped separately.

The Madera soils are at elevations of 100 to 250 feet in a subhumid climate that has a mean annual precipitation of 12 to 14 inches. The frost-free period is about 300 days.

Meikle series

The Meikle series consists of imperfectly drained, fine-textured soils. The soils are in imperfectly drained, ponded basins under a vegetation that consists of forbs, grasses, and sedges.

These soils are characterized by a thin, gray sandy clay loam surface soil that abruptly overlies a blocky clay subsoil. The subsoil generally contains some lime in the lower part. Reaction increases from slightly acid in the surface soil to moderately alkaline in the lower subsoil. The parent material was derived largely from granitic rock and consists of alluvium on the same terrace level as the Hanford soils, mixed to some extent with alluvium or colluvium eroded from areas of Whitney and Rocklin soils.

The Meikle soils are east of Waterford and Hickman. They are in basins formed in drainageways between hills occupied by Whitney soils. In these basins the drainage has been blocked by the deposition of granitic alluvium by the Tuolumne River and other major streams. The soils on the blocking alluvium are generally of the Hanford or Dinuba series. Greenfield or Snelling soils are

along minor drainageways above the ponded areas of the Meikle soils.

The Meikle soils are at elevations of 100 to 250 feet in a semiarid to subhumid climate that has a mean annual precipitation of about 14 inches. The growing season is about 280 days.

These soils are used for dry-farmed grain and range or for irrigated pasture.

Modesto series

The Modesto series consists of moderately well drained, medium and moderately fine textured soils. These soils developed from rather gritty sandy loam or loam-textured alluvium underlain in many places by a silty substratum like that underlying the Dinuba soils. The alluvium was derived mainly from granitic rocks. These soils occur on nearly level alluvial fans in areas where runoff is very slow. They had a mound microrelief that has been almost completely obliterated by leveling.

The surface soil is charateristically grayish-brown loam and clay loam. It is slightly acid to neutral. The subsoil is blocky to prismatic light clay or sandy clay. It is neutral to moderately alkaline and intermittently calcareous in the lower part. It is underlain by sandy alluvium or an unrelated silty substratum. This material is cemented with lime in places and forms a weak, thin hardpan.

Modesto soils are in the same general area as the Chualar, Dinuba, and Hanford soils, north and northwest of Modesto. They are at elevations of 40 to 100 feet in a semiarid climate that has a mean annual precipitation of 10 to 12 inches. The average frost-free period is about 300 days.

These soils are used for a wide variety of field and forage crops and for orchards and vineyards. The slow water penetration and the tendency of the soil to puddle, however, generally reduce yields.

Montpellier series

The Montpellier series consists of well-drained, moderately coarse textured soils. These soils developed from alluvium derived from granitic rock. They occur on dissected, old high terraces that have smooth, undulating to hilly relief. They are under an annual grass forb vegetation.

The surface soil is characteristically brown, slightly acid coarse sandy loam. The subsoil is dense, red or reddish-brown, medium acid sandy clay loam. The parent material is coarse sandy loam alluvium that contains partially weathered minerals similar to those in granitic rocks. In places it is weakly to moderately consolidated.

These soils are in the area southeast of Oakdale and east of Waterford, Hickman, and Denair to the vicinity of La Grange. They are associated with the Whitney and Rocklin soils.

Montpellier soils are at elevations of 200 to 400 feet in a subhumid climate that has a mean annual precipitation of 14 to 18 inches. The frost-free period ranges from 250 to 280 days.

These soils are important in the production of dry-farmed grain, irrigated pasture, and range pasture.

Oakdale series

The soils of the Oakdale series are well drained, deep, moderately coarse textured, and moderately permeable. They developed from alluvium derived mainly from granitic rocks. They occur on nearly level to gently undulating relief under annual grasses and oaks.

These soils are characteristically grayish-brown sandy loams that have slightly more clay in the subsoil than in the surface soil and are slightly mottled in places. The parent material is soft sandy loam that contains much angular quartz sand and slightly weathered feldspar and mica.

These soils are along the benches of the Stanislaus River in the vicinity of Oakdale. They are associated with the Hanford, Tujunga, and Dinuba soils.

The Oakdale soils are at elevations of 100 to 250 feet in a subhumid climate that has a mean annual precipitation of 12 to 14 inches. The frost-free period is about 250 days.

These soils are important for growing fruit and nut crops and forage and field crops. They are well suited to deep-rooted crops.

Paulsell series

The Paulsell series consists of imperfectly drained, fine-textured soils. These soils developed from lake sediments derived mainly from basic igneous rocks (andesitic tuff and meta-andesite). They are in nearly level areas that are drained by sharply incised streams. The vegetation is mainly annual grasses and small herbaceous plants.

These soils are characteristically dark-gray clay with moderate, blocky structure. The surface soil is slightly acid, but it becomes mildly alkaline below about 24 inches. The parent material is stratified alluvium that is moderately coarse to moderately fine textured. It contains large amounts of weatherable feldspar and dark minerals and little quartz or mica.

These soils are along Dry Creek in the Paulsell Valley. They are in the same general area as the Ryer and Yokohl soils.

The Paulsell soils are at elevations of 150 to 200 feet in a subhumid climate that has a mean annual precipitation of 12 to 14 inches. The frost-free period is about 250 days.

These soils are used for rice and irrigated pasture.

Pentz series

The soils of the Pentz series are well drained to excessively drained and medium or moderately coarse textured. They developed from andesitic tuff. They have mainly hilly to steep relief but in some areas are undulating or rolling. Weakly developed mound microrelief occurs locally. The vegetation consists of annual grasses and forbs and some wild clover.

The Pentz soils are characteristically grayish brown, slightly acid, and usually very shallow or shallow to rock. They are moderately deep in some places where the parent rock is soft. The parent material is generally a bluish-gray sandstone or brownish mudstone composed largely of andesitic tuff.

These soils occur in small to moderately large tracts over a wide area north and east of Oakdale and Waterford. They are associated with the Peters and Raynor soils, formed from similar material, and the Keyes soils, formed from gravelly andesitic alluvium.

The Pentz soils are at elevations of 200 to 600 feet in a subhumid climate that has a mean annual precipitation

of 13 to 16 inches. The frost-free period is 250 to 300 days.

These soils are used entirely for range pasture.

Peters series

The Peters series consists of well-drained, fine-textured soils. These soils developed from andesitic tuff. They occur on gently sloping to sloping relief under grass-bur clover vegetation.

The Peters soils are characteristically dark-gray, gravelly or cobbly clay, 12 to 20 inches deep. They have blocky structure. The parent material consists of tuffaceous andesitic sediments that vary in hardness.

These soils are scattered over a wide area east of Oakdale and Waterford. They are associated with the Pentz, Raynor, and Keyes soils and in many places form a complex with the Pentz soil. Some areas of the Redding and Corning soils also occur in the same area.

Peters soils are at elevations of 300 to 600 feet in a subhumid climate that has a mean annual precipitation of 13 to 16 inches. The frost-free period is about 300 days.

These soils are valued highly for range pasture.

Raynor series

The Raynor series consists of well-drained, fine-textured soils. These soils developed from andesitic tuff similar to that from which the Pentz and Peters soils developed. They occur on gently sloping relief that is concave in places. The vegetation is annual grasses, forbs, and clover.

These soils are characteristically dark, moderately deep to deep, slightly acid, blocky clay. When the soils are dry, deep, wide cracks form and the surface has a strong, fine, granular structure.

These soils are in the area east of Oakdale. They are associated with the Pentz, Peters, Redding, Keyes, and Zaca soils.

The Raynor soils are at elevations of 200 to 400 feet in a climate that has a mean annual precipitation of 13 to 16 inches. The frost-free period is about 300 days.

These soils are important only for the production of range and a little dry-farmed grain.

Redding series

The Redding series is made up of well-drained, cobbly and gravelly, medium-textured soils. These soils developed from mixed gravelly alluvium, mainly from metamorphic and quartzitic rocks. They are on gently sloping, partially dissected high terraces and old fans that have distinct mound microrelief. The vegetation consists of annual grasses and forbs.

The surface soil is characteristically light brown to reddish brown. The subsoil is reddish-brown gravelly clay. It rests abruptly on an iron-silica cemented hardpan at a depth of about 18 inches.

These soils occur throughout the area north and east of Oakdale and Waterford. They are associated with the Corning soils, which are similar but lack the cemented hardpan, and with the Pentz, Peters, and Raynor soils, which formed on the andesitic tuff that generally underlies the Redding gravel.

Redding soils are at elevations of 200 to 600 feet in a climate that has a mean annual precipitation of 14 to 18 inches. The average frost-free period is 250 to 300 days.

These soils are used for range pasture and a little dry-farmed grain.

Riverwash

Riverwash consists of sandy areas adjacent to streams. These areas include dry riverbeds, stream channels, and sandbars and are subject to periodic flooding. Sand and gravel pits are generally in areas of this material. Riverwash has no agricultural value except for very limited grazing or browse.

Rocklin series

The Rocklin series consists of well-drained, moderately coarse textured soils with cemented hardpans. The soils developed from weakly consolidated granitic rock sediments. They have undulating relief. The vegetation consists of grasses and small herbaceous plants.

These soils characteristically have a brown to reddish-brown, moderately coarse textured surface soil. They have a reddish-brown sandy clay loam subsoil that overlies a thin, iron-silica cemented hardpan. The hardpan formed at the surface of the underlying sediments, at a depth of 18 to 30 inches. The parent material consists of weakly consolidated sediments that contain quartz and slightly weathered feldspar and mica.

These soils are in an area east of Denair that extends nearly to Turlock Lake. They are associated with the Whitney, Montpellier, and San Joaquin soils. Some areas of Rocklin soils are mapped in undifferentiated units with the Whitney soils.

The Rocklin soils are at elevations of 150 to 300 feet in a subhumid climate that has a mean annual precipitation of 13 to 15 inches. The frost-free period is 250 to 300 days.

These soils are important in the production of dry-farmed grain and some irrigated pasture.

Rossi series

The soils of the Rossi series are poorly drained, fine and moderately fine textured, dark, and saline-alkali. They developed from fine-textured alluvium derived from mixed but predominantly granitic rocks. The soils are subject to occasional flooding. They are moderately to strongly affected by salts and alkali. They occur on nearly level basin relief under a vegetation that consists mainly of saltgrass and sedges.

The surface soil is characteristically dark-gray, blocky clay. The subsoil is gray, calcareous, subangular blocky heavy clay. It is underlain by light-gray, mottled clay loam or clay.

These soils are west of Gates Road. They are associated with the Traver and Waukena soils.

The Rossi soils are at elevations of 30 to 50 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The average frost-free period is about 250 days.

These soils are used for range and irrigated pasture.

Ryer series

The soils of the Ryer series are well drained and medium to fine textured. They developed from alluvium derived from metamorphic rocks, mainly of basic volcanic origin. These soils are on nearly level terraces that have

weak, mound microrelief in places. The vegetation consists of annual grasses and forbs.

The surface soil is characteristically brown to reddish-brown loam, clay loam, or clay. In many places the clay subsoil is slightly calcareous in the lower part. The parent material is generally compact alluvium that has loam texture.

These soils are along Dry Creek from Empire to Cooperstown. They are associated with the Honcut, Wyman, and Yokohl soils, which developed from similar parent material and have similar color.

The Ryer soils are at elevations of 150 to 250 feet in a climate that has a mean annual precipitation of 14 to 16 inches. The average frost-free period is about 250 days.

These soils are used for irrigated pasture, rice, and range pasture; small acreages are planted to crops needing more intensive management.

San Joaquin series

The San Joaquin series is made up of well-drained, moderately coarse textured soils with iron-silica hardpans. The soils developed from alluvium derived mainly from granitic rocks. They have very gently sloping to undulating relief. Areas that have not been cultivated have, also, a well-developed mound microrelief. The vegetation consists of grasses and small herbaceous plants, mainly filaree.

The San Joaquin soils are characteristically brown to reddish brown and slightly to medium acid. The subsoil is reddish-brown or red clay that rests on an indurated hardpan at a depth of 16 to 30 inches.

These soils are in a large area southwest of Oakdale and in smaller areas near Hickman and Denair. They are associated with the Madera and Alamo soils and in places with the Rocklin and Montpellier soils.

The San Joaquin soils are at elevations of 100 to 300 feet in a subhumid climate that has a mean annual precipitation of 11 to 16 inches. The frost-free period is about 275 days.

These soils are important in the production of irrigated pasture and dry-farmed grain.

Schist rockland

This miscellaneous land type consists of areas of rock slabs that stand nearly upright. Some soil material is in patches between the slabs. Schist rockland is mapped in association with the Exchequer, Auburn, and Whiterock soils. It has no agricultural value.

Snelling series

The soils of the Snelling series are well drained and moderately coarse textured. They developed from granitic alluvium. They occur on smooth, nearly level to undulating relief under annual grasses and forbs and scattered oaks.

The surface soil is characteristically brown, slightly acid sandy loam. The subsoil is brown, weak blocky to massive sandy clay loam. The parent material is moderately coarse textured alluvium.

These soils are on low terraces along the Stanislaus and Tuolumne Rivers east of Waterford, Hickman, and Oakdale. They are associated with the Greenfield and Montpellier soils.

The Snelling soils are at elevations of 100 to 350 feet in a subhumid climate that has a mean annual precipitation of 12 to 15 inches. The average frost-free period is 250 to 300 days.

These soils are used for a variety of crops, including orchard crops, field crops, and grain, and for irrigated pasture and some dry-farmed and range pasture.

Temple series

The soils of the Temple series are imperfectly and poorly drained and medium to fine textured. They developed from alluvium of mixed but mainly granitic origin. They are on nearly level flood plains that, early in summer, are subject to occasional floods that drain off slowly. Alluvial deposition is very slow. These soils are slightly to moderately saline in places. The vegetation consists of annual and perennial grasses, herbaceous plants, and some oak, willow, and cottonwood.

The Temple soils are characteristically gray to dark gray and have a high content of organic matter. The subsoil is blocky and calcareous and has slightly more clay than the surface soil. The parent material is stratified, micaceous alluvium generally of fine sandy loam, loam, or silt loam texture.

These soils are along the flood plain of the San Joaquin River. They are associated with the Columbia soils.

The Temple soils are at elevations of 25 to 50 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The frost-free period is about 250 days.

These soils are used for alfalfa, sorghum, irrigated pasture, and range.

Terrace escarpments

This miscellaneous land type consists of outcrops of soft and weakly consolidated sandy or silty sediments and a little soil material in places. Terrace escarpments are generally steep and subject to gully erosion. They occur on either side of the bottom lands of the Stanislaus and Tuolumne Rivers. They are sometimes used for grazing. If they are grazed heavily, gullies form and may cut into the farmland on the terraces above, and sand may be deposited on the fertile soils of the flood plains below.

Toomes series

The soils of the Toomes series are well drained, rocky, medium textured, and very shallow. They developed from lava-flow rock. They occur on gently sloping to undulating relief under annual grasses and forbs.

The Toomes soils are characteristically brown, rocky loam that is medium acid and less than 12 inches thick. The parent material is fine-grained latite lava.

These soils are associated with lava rockland or scabland consisting of jumbled fresh lava.

The Toomes soils are at elevations of about 300 feet but extend up to about 1,200 feet in the area toward the east. They are in a subhumid climate that has a mean annual precipitation of about 16 inches. The frost-free period is about 300 days.

These soils are used only for range pasture.

Traver series

The Traver series consists of moderately well drained, moderately coarse textured, saline-alkaline soils. These soils formed from granitic alluvium. They are on nearly level valley plains that have slight mound microrelief in

places. The vegetation consists of saltgrass, foxtail, spikeweed, and other alkali-tolerant plants.

The Traver soils are characteristically light brownish gray, calcareous, and moderately to strongly alkaline throughout. The subsoil is slightly finer textured than the surface soil. The parent material is moderately coarse textured alluvium made up primarily of quartz, feldspar, and mica derived from granitic rock.

These soils are mainly east of the San Joaquin flood plain in a band about 2 miles wide. They are associated with the Fresno and Waukena soils.

The Traver soils are at elevations of 35 to 60 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The frost-free period is about 250 days.

These soils are used mainly for irrigated and dryland pasture.

Tuff rockland

This miscellaneous land type consists of areas of bare tuff rock and steep rocky escarpments. The rock is only moderately hard. In many places it can be graded with heavy equipment without the use of explosives. Tuff rockland is associated with the Amador and Pentz soils. It has no agricultural value.

Tujunga series

The soils of the Tujunga series are somewhat excessively to excessively drained and coarse textured. They developed from very recent alluvial deposits derived from granitic rocks. They are on nearly level to gently sloping alluvial fans and flooded bottom lands. The vegetation consists of annual grasses and forbs; willow and poplar grow on the bottom lands.

The Tujunga soils are characteristically pale-brown to light brownish-gray, stratified, loose sand or loamy sand. They are neutral to mildly alkaline. The parent material is fresh granitic sand.

These soils are on the bottom lands and fans of the Stanislaus and Tuolumne Rivers. They are associated with the Grangeville, Hanford, and Foster soils.

The Tujunga soils are at elevations of 35 to 100 feet in a subhumid climate that has a mean annual precipitation of 10 to 15 inches. The frost-free period is about 250 days.

These soils are used mainly for range pasture. In many places they interfere with the irrigation of intensively managed crops on the finer textured soils with which they are associated.

Waukena series

The soils of the Waukena series are imperfectly drained, moderately coarse textured, and saline-alkali. They developed from moderately coarse textured granitic alluvium. They are in nearly level areas that have distinct mound microrelief in places. The vegetation consists of saltgrass and other salt-tolerant plants.

The surface soil is characteristically gray sandy loam. It rests abruptly on a columnar sandy clay loam subsoil that is strongly alkaline.

These soils are in a narrow band east of the San Joaquin River flood plain. They are rarely flooded. They are associated with the Fresno, Traver, and Rossi soils, which are also saline-alkali.

The Waukena soils are at elevations of 35 to 60 feet in a semiarid climate that has a mean annual precipitation of 8 to 10 inches. The frost-free period is about 250 days.

These soils are important mainly for the growing of irrigated pasture and saltgrass range.

Whiterock series

The soils of the Whiterock series are well drained to excessively drained, medium textured, very shallow, and rocky. They developed from metasedimentary rock (light-colored slate and metasandstone). They occur on gently sloping to steep relief under grasses, forbs, and scattered oaks.

The Whiterock soils are characteristically light brownish gray and slightly acid. They have numerous tombstonelike rock outcrops. The parent material is hard slate that generally has a steep to nearly vertical dip.

These soils are along the eastern boundary of the Area. They are associated with the Auburn and Exchequer soils.

The Whiterock soils are at elevations of 300 to 1,000 feet in a subhumid climate that has a mean annual precipitation of 15 to 25 inches. The frost-free period is about 300 days.

These soils are used only for range pasture.

Whitney series

The Whitney series is made up of well-drained and somewhat excessively drained, moderately coarse textured soils. These soils developed from weakly consolidated sediments derived from granitic rocks. They are mainly on rolling to hilly relief in areas of strongly dissected old terraces and fans. The vegetation consists of annual grasses and small herbaceous plants, including wild clover.

The Whitney soils are characteristically brown, slightly acid sandy loam or fine sandy loam. The subsoil contains slightly more clay than the surface soil. The parent material is high in quartz and slightly weathered feldspar and mica. These soils grade at variable depth (usually at a moderate depth) into weakly consolidated granitic sediments.

These soils are in areas east of Denair, Hickman, and Waterford. They are associated with the Montpellier and Rocklin soils, which are in areas with more gentle relief.

The Whitney soils are at elevations of 150 to 400 feet in a subhumid climate that has a mean annual precipitation of 13 to 15 inches. The frost-free season is 250 to 300 days.

These soils are important in the production of dry-farmed grain and range.

Wyman series

The soils of the Wyman series are well drained and medium to moderately fine textured. They developed from alluvium derived mainly from basic igneous rocks. They are on very smooth, nearly level relief on low terraces along minor streams that drain the foothills of the Sierra Nevada. The vegetation consists of annual grasses and small herbaceous plants, including wild clover.

The Wyman soils are characteristically brown, neutral loam and clay loam. The subsoil has slightly more clay than the surface soil. In the lower subsoil, there are intermittent deposits of lime. The parent material consists of moderately coarse textured sediments that contain a large amount of weatherable feldspar and dark minerals.

These soils are along Dry Creek from Waterford east to the county line. They are associated with the Honcut,

Ryer, and Yokohl soils, which were developed from similar parent material.

The Wyman soils are at elevations of 100 to 300 feet in a subhumid climate that has a mean annual precipitation of 13 to 16 inches. The frost-free period is about 250 days.

These soils are used for walnuts, alfalfa, field crops, and irrigated pasture.

Yokohl series

The Yokohl series is made up of well-drained, medium or moderately fine textured soils that have iron-silica hardpans. They developed in alluvium derived from metamorphosed basic igneous rock. They have nearly level or very gently sloping relief. Mound microrelief occurs on the low alluvial terraces near minor streams that drain the Sierra Nevada foothills. The vegetation consists of annual grasses and forbs.

The surface soil is characteristically brown to reddish-brown loam or clay loam. The subsoil is prismatic clay that rests on a strongly cemented hardpan at a depth of 24 to 38 inches. The parent material is medium-textured alluvium.

These soils are along the upper part of Dry Creek. They are associated with the Honcut, Wyman, and Ryer soils, which have developed from similar parent material.

The Yokohl soils are at elevations of 150 to 250 feet in a subhumid climate that has a mean annual precipitation of 14 to 16 inches. The frost-free period is about 250 days.

Where water is available, these soils are used for irrigated pasture. Several large areas are used only for range pasture or dry-farmed grain.

Zaca series

The Zaca series consists of well-drained, fine-textured soils that developed from calcareous sedimentary rock. These soils are on undulating to hilly relief. The vegetation consists of annual grasses and herbs and includes a large amount of clover.

The Zaca soils are characteristically dark-gray, calcareous clay. The surface soil has a strong granular structure, and the subsoil has a blocky structure that was formed by deep, wide cracks. The parent material is calcareous shale or mudstone, possibly of lacustrine origin.

Many areas of these soils are about 5 miles east of Oakdale. They are associated with the Peters and Raynor soils, which formed from andesitic tuff, and the Keyes soils, which formed from andesitic gravel.

The Zaca soils are at elevations of 200 to 400 feet in a climate that has a mean annual precipitation of 13 to 16 inches. The frost-free period is about 300 days.

These soils are used mainly for range pasture.

Descriptions of the Mapping Units

The name of each mapping unit, the symbol by which it is shown on the map, and the symbol of the capability unit in which it is grouped are given in table 2. Also, the important characteristics and qualities of each mapping unit, and suitable uses for the unit, are summarized. More detailed information about use, management, and productivity of the mapping units is given in the section "Use, Management, and Productivity of Soils."

Some of the terms used in the table headings are discussed in the following paragraphs.

Drainage is given by general relative soil-drainage classes defined in the "Soil Survey Manual" (*20*). The classes are *very poor*, *poor*, *imperfect*, *moderately good*, *good*, *somewhat excessive*, and *excessive*.

Permeability is the quality of a porous material, such as soil, to transmit fluids. Permeability of soil is expressed by the rate of percolation. As measurements have not been made on these soils, the ratings given in the table are estimates. The estimates were based on the rate of percolation, by gravity, through a saturated core of soil about 3 inches in diameter and 3 inches in thickness. Cores for this purpose are taken with the least possible disturbance of natural soil structure. The permeability rating is a general indication of the ease of root penetration. The classes and their percolation rates are:

Very slow: Less than 0.05 inch per hour.
Slow: 0.05 to 0.20 inch per hour.
Moderately slow: 0.20 to 0.80 inch per hour.
Moderate: 0.80 to 2.50 inches per hour.
Moderately rapid: 2.50 to 5.00 inches per hour.
Rapid: 5.00 to 10.00 inches per hour.
Very rapid: More than 10.00 inches per hour.

Runoff, sometimes called surface runoff or external soil drainage, refers to the relative rate water is removed by flow over the surface of the soil. The six classes of runoff, as defined in the "Soil Survey Manual" (*20*), are *ponded*, *very slow*, *slow*, *medium*, *rapid*, and *very rapid*.

Erosion hazard is an estimate of the risk of erosion if the soil is cultivated or heavily grazed. Ratings, except where specified, refer to the risk of erosion by water. The ratings are *none*, *slight*, *moderate*, *high*, and *very high*.

Natural fertility is an estimate of the natural capacity of the soil to provide the proper nutrients, in the proper amounts and in the proper balance, for growth of the usual crops when other factors, such as light, temperature, and physical conditions of the soil, are favorable. The terms used are *very low*, *low*, *moderate*, and *high*.

Available water-holding capacity is the amount of water that can be held in a soil in a form available to plants. Technically it is the difference between the amount of water in a soil at field capacity and the amount at the permanent wilting point.

Use, Management, and Productivity of Soils

Discussed in this section are important crops and their general management; irrigation and drainage; saline and saline-alkali soils; soil profile groups, natural land type groups, and Storie index ratings; capability groups; and crop yields.

Important Crops and General Management Practices

Because of the wide diversity of soils, the long, warm growing season, and the adequate supply of irrigation water, a great many crops can be produced in the Area. Included in the 80 different crops listed by the annual crop report for Stanislaus County in 1954 are tree fruits, nuts, berries, grapes, field, forage, truck, and seed crops,

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
AcA	Alamo clay, 0 to 1 percent slopes.	Shallow, nearly level depressions in gently undulating alluvial fans and terraces.	Dark-gray clay, very hard, slightly acid, weak blocky; dark-gray clay, very hard, neutral, strong blocky; indurated iron-silica hardpan.	Poor	Very slow, none through hardpan.	Very slow or ponded.
AgB	Amador gravelly loam, 0 to 8 percent slopes.	Undulating uplands that have mound microrelief and few or no rock outcrops.	Light yellowish-brown gravelly loam, slightly hard, very strongly acid, massive; none; white rhyolitic clay rock, very strongly acid.	Good	Moderate	Very slow to medium.
AmB	Amador loam, 0 to 8 percent slopes.	Undulating uplands that have mound microrelief and few or no outcrops of rock.	Light yellowish-brown gravelly loam, slightly hard, very strongly acid, massive; none; white rhyolitic clay rock, very strongly acid.	Good	Moderate	Very slow to medium.
AmD	Amador loam, 8 to 30 percent slopes.	Hilly uplands that have a few rock outcrops.	Light yellowish-brown gravelly loam, slightly hard, very strongly acid, massive; none; white rhyolitic clay rock, very strongly acid.	Somewhat excessive.	Moderate	Medium to rapid.
AmF	Amador loam, 30 to 60 percent slopes.	Steep uplands; 15 to 20 percent rock outcrops.	Light yellowish-brown gravelly loam, slightly hard, very strongly acid, massive; none; white rhyolitic clay rock, very strongly acid.	Excessive	Moderate	Very rapid.
AnA	Anderson gravelly fine sandy loam, 0 to 3 percent slopes.	Narrow alluvial bottoms and fans of small streams and drainageways.	Brown gravelly fine sandy loam, slightly hard, medium acid, massive; reddish-brown very gravelly sandy loam, hard, slightly acid, very weak blocky; stratified gravelly sandy loam and sand, light reddish brown, loose.	Somewhat excessive (occasional flooding).	Very rapid	Very slow
AnB	Anderson gravelly fine sandy loam, 3 to 8 percent slopes.	Narrow alluvial bottoms and fans of small streams and drainageways.	Brown gravelly fine sandy loam, slightly hard, medium acid, massive; reddish-brown very gravelly sandy loam, hard, slightly acid, very weak blocky; stratified gravelly sandy loam and sand, light reddish brown, loose.	Somewhat excessive.	Very rapid	Slow to medium.
AoA	Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes.	Narrow alluvial bottoms cut by braided, shallow channels and gullies.	Brown gravelly fine sandy loam, slightly hard, medium acid, massive; reddish-brown very gravelly sandy loam, hard, slightly acid, very weak blocky; stratified gravelly sandy loam and sand, light reddish brown, loose.	Somewhat excessive (occasional flooding).	Very rapid	Very slow
AuB	Auburn clay loam, 3 to 8 percent slopes.	Undulating uplands that have occasional rock outcrops.	Brown to yellowish-red clay loam, hard, slightly acid, weak subangular blocky; reddish-brown heavy clay loam, hard, slightly acid, weak blocky; weathered greenstone schist.	Good	Moderately slow.	Slow to medium.
AuD	Auburn clay loam, 8 to 20 percent slopes.	Hilly uplands that have some scattered rock outcrops.	Brown to yellowish-red clay loam, hard, slightly acid, weak subangular blocky; reddish-brown heavy clay loam, hard, slightly acid, weak blocky; weathered greenstone schist.	Good to somewhat excessive.	Moderately slow.	Medium to rapid.

Eastern Stanislaus Area

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
None	14 to 20 inches (rarely up to 30 inches) to hardpan.	Low	3 to 5	Dry-farmed grain, irrigated pasture.	IIIw-5	Suitable for crops grown and possibly other shallow-rooted crops adapted to soils with clay texture; because of excessive moisture in spring, the soil is difficult to manage with surrounding sandier soils; drainage can be improved locally by installing surface drains; yields of small grains are low in wet years but may exceed those on surrounding better drained soils in dry years.
Slight	2 to 14 inches to bedrock.	Very low	¼ to 1½	Range	VIIe-9	Range; not suitable for reseeding.
Slight	2 to 14 inches to bedrock.	Very low	¼ to 1½	Range	VIIe-9	Range; not suitable for reseeding.
Moderate to high.	2 to 10 inches to bedrock.	Very low	¼ to 1	Range	VIIe-9	Range; not suitable for reseeding; careful grazing needed to control erosion.
Very high	2 to 10 inches to bedrock.	Very low	¼ to 1	Range	VIIe-9	Range; not suitable for reseeding; careful grazing needed to control erosion.
Slight	Usually more than 6 feet; small areas shallow over bedrock are included.	Low	2 to 4	Range	IIIs-4	If water could be obtained, larger areas of this soil would be fairly well suited to irrigated crops; frequent, light irrigation would be necessary; livestock carrying capacity is fair to poor, depending on local moisture conditions.
Slight	More than 6 feet	Low	2 to 4	Range	IIIs 4	If water could be obtained, larger areas of this soil would be fairly well suited to irrigated crops; frequent, light irrigation would be necessary; sprinkler irrigation would be advisable; livestock carrying capacity is poor.
Channel cutting only.	More than 6 feet	Low	2 to 4	Range	IIIs 4	Range; fairly well suited to other uses when smoothed and leveled.
Slight	16 to 24 inches to hard rock.	Moderate	3 to 5	Range	IVe-3	Range; some areas would be suitable for pasture or shallow-rooted crops if water could be obtained; livestock carrying capacity is fair to good.
Moderate	16 to 24 inches to hard rock.	Moderate	3 to 5	Range	VIe-3	Range; not suited to cultivated crops because of shallowness, scattered rock outcrops, and inclusions of very shallow Exchequer soils.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
BcA	Bear Creek clay loam, 0 to 3 percent slopes.	Narrow bottoms and flood plains of minor streams.	Dark-gray clay loam, slightly hard, slightly acid, weak blocky; dark-gray, cobbly sandy clay, slightly hard, slightly acid to neutral, blocky; unrelated andesite tuff rock.	Moderately good (occasional flooding).	Moderately slow.	Very slow to slow.
BeA	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes.	Narrow bottoms cut with braided channels and gullies.	Dark-gray clay loam, slightly hard, slightly acid, weak blocky; dark-gray cobbly sandy clay, slightly hard, slightly acid to neutral, blocky; unrelated andesite tuff rock.	Moderately good (occasional flooding).	Moderately slow.	Very slow to slow.
BgA	Bear Creek gravelly loam, 0 to 3 percent slopes.	Narrow bottoms and flood plains of minor streams.	Dark-gray clay loam, slightly hard, slightly acid, weak blocky; dark-gray cobbly sandy clay, slightly hard, slightly acid to neutral, blocky; unrelated andesite tuff rock.	Moderately good (occasional flooding).	Moderately slow.	Very slow to slow.
BmA	Bear Creek loam, 0 to 3 percent slopes.	Narrow bottoms and flood plains of minor streams.	Dark-gray clay loam, slightly hard, slightly acid, weak blocky; dark-gray cobbly sandy clay, slightly hard, slightly acid to neutral, blocky; unrelated andesite tuff rock.	Moderately good (occasional flooding).	Moderately slow.	Very slow to slow.
CaA	Chualar sandy loam, 0 to 3 percent slopes.	Nearly level alluvial fans and terraces.	Grayish-brown sandy loam, soft, slightly acid to neutral, massive; brown sandy clay loam, hard, neutral, weak blocky, faintly mottled; brown sandy loam, soft, neutral, massive, faintly mottled, overlying unrelated silt loam in a few places.	Moderately good.	Moderately slow.	Very slow
CbA	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes.	Nearly level alluvial fans and terraces.	Grayish-brown sandy loam, soft, slightly acid to neutral, massive; brown sandy clay loam, hard, neutral, weak blocky, faintly mottled; brown sandy loam, soft, neutral, massive, faintly mottled, overlying unrelated silt loam in a few places.	Moderately good.	Moderately slow.	Very slow
CcA	Columbia fine sandy loam, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown fine sandy loam, soft, massive, about neutral; light brownish-gray stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; similar to subsoil but neutral to slightly acid.	Imperfect	Moderately rapid	Very slow
CdA	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown fine sandy loam, soft, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; similar to subsoil but neutral to slightly acid.	Imperfect	Moderately rapid.	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	36 to 54 inches to unrelated bedrock substratum.	Moderate	7 to 10	Range, irrigated pasture, dry-farmed grain.	IIs–3	Suited to crops grown; larger areas could be used for other irrigated field crops.
Moderate channel erosion.	36 to 54 inches to unrelated bedrock substratum.	Moderate	5 to 7	Range	IVe–3	Range; limited suitability to other uses if smoothed and leveled.
Slight	36 to 54 inches to unrelated bedrock substratum.	Moderate	5 to 7	Range, grain, irrigated pasture.	IIs–3	Suited to crops grown; larger areas can be used for irrigated field crops.
Slight	36 to 54 inches to unrelated bedrock substratum.	Moderate	7 to 10	Range, grain, irrigated pasture.	IIs–3	Suited to crops grown; larger areas can be used for irrigated field crops.
Slight	More than 6 feet	Moderate to high.	7 to 10	Orchard crops, field crops, vegetables, grapes.	IIs–7	Suitable for a wide variety of crops; tends to compact if worked when too moist; deficient in nitrogen and zinc for orchard and vineyard crops, and, locally, in sulfur for legumes.
Slight	More than 6 feet	Moderate to high.	7 to 10	Field crops, irrigated pasture.	IIs–6	Suitable for a wide variety of crops; tends to compact if worked when too moist; deficient in nitrogen and zinc for orchard and vineyard crops, and, locally, in sulfur for legumes; best suited to field crops and irrigated pasture; not suited to orchards or vineyards unless drained and salts and alkali are removed.
Slight	More than 6 feet	High	9 to 12	Alfalfa, irrigated pasture, field crops, range.	IIw–2	Areas protected by levees are suitable for alfalfa, irrigated pasture, and field crops; weeds are troublesome; unprotected areas are suitable for range and, in dry years, for milo maize and grain without irrigation; levees require continued maintenance.
Slight	More than 6 feet	Low	9 to 12	Range pasture	IIIw–6	Barley and range pasture; salt reclamation is difficult because of lack of drainage outlets; reclamation should probably await better flood control on the San Joaquin River.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
CeA	Columbia loam, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; similar to subsoil but neutral to slightly acid.	Imperfect	Moderate	Very slow
CfA	Columbia silt loam, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; similar to subsoil but neutral to slightly acid.	Imperfect	Moderate	Very slow
CgA	Columbia silt loam, slightly saline, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; similar to subsoil but neutral to slightly acid.	Imperfect	Moderate	Very slow
ChA	Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; light-gray silt loam, compact, cemented in places, calcareous.	Imperfect	Moderate	Very slow
CkA	Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; dark-gray silty clay loam; resembles Temple soils.	Imperfect	Moderate	Very slow
CmA	Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; slight brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; dark-gray silty clay loam; resembles Temple soils.	Imperfect	Moderate	Very slow
CoA	Columbia silty clay loam, slightly saline, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled grayish-brown silt loam, slightly hard, massive, about neutral; light brownish-gray, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, neutral, mottled; light-brown, stratified fine sandy loam, loamy fine sand, and silt loam, soft, massive, mottled.	Imperfect	Moderately slow.	Very slow
CpA	Columbia soils, 0 to 1 percent slopes.	Nearly level flood plains subject to occasional flooding and high water table.	Mottled brown, stratified sand, loamy fine sand, and loam; same as surface soil; same as subsoil.	Imperfect	Variable; moderate to very rapid.	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	More than 6 feet	High	10 to 14	Alfalfa, field crops, irrigated pasture, range.	IIw-2	Areas protected by levees are suitable for alfalfa, irrigated pasture, and field crops; weeds are troublesome; unprotected areas are suitable for range and, in dry years, for milo maize and grain without irrigation; levees require continued maintenance; small areas of sandy loam soils and of Temple soils are included.
Slight	More than 6 feet	High	10 to 14	Alfalfa, field crops, irrigated pasture, range.	IIw-2	Areas protected by levees are suitable for alfalfa, irrigated pasture, and field crops; weeds are troublesome; unprotected areas are suitable for range and, in dry years, for milo maize and grain without irrigation; levees require continued maintenance.
Slight	More than 6 feet	Moderate	More than 9	Alfalfa, field crops, irrigated pasture.	IIw-2	Irrigated alfalfa, field crops, pasture; crops are affected by salts in small spots; soil puddles if worked when too moist; flood-control levees require continued maintenance.
Slight	36 to 48 inches	Moderate	6 to 8	Irrigated pasture, alfalfa, barley.	IIIw-3	Irrigated pasture, alfalfa, barley; growth is spotty; continued irrigation and improved flood control on the San Joaquin River should alleviate, in time, the saline-alkali condition.
Slight	Root depth more than 6 feet (Temple soil 12 to 36 inches below surface).	High	More than 9	Alfalfa, irrigated pasture, field crops.	IIw-2	Irrigated alfalfa, pasture, barley; substratum is high in organic matter and has only a small effect on crop growth and permeability, thus management is much the same as on Columbia fine sandy loam, 0 to 1 percent slopes; irrigation water should be applied slowly.
Slight	Root depth more than 6 feet (Temple soil 12 to 36 inches below surface).	Moderate	More than 9	Alfalfa, irrigated pasture, field crops.	IIw-2	Irrigated pasture, alfalfa, field crops; growth is spotty; complete salt reclamation is difficult because of fluctuating water table.
Slight	More than 6 feet	Moderate	More than 9	Pasture alfalfa	IIw-2	Irrigated pasture, alfalfa, field crops; soil dries out slowly and is easily puddled if cultivated when too moist; fairly difficult to work; complete removal of salts is difficult because of the fluctuating water table.
Slight	More than 6 feet	Moderate	Variable, 3 to 9.	Range	IIw-2	Range and field crops; uniform application of irrigation water is difficult; crop growth in irrigated areas is spotty; best remedy is probably a thorough mixing of the soil by plowing to a depth of 3 feet or more.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
CsB	Columbia soils, channeled, 0 to 8 percent slopes.	Flood plain cut by numerous channels and oxbows, causing a series of ridges.	Mottled brown, stratified sand, loamy fine sand, and loam; same as surface soil; same as subsoil.	Imperfect___	Variable; moderate to very rapid.	Very slow____
CyB	Corning gravelly sandy loam, 3 to 8 percent slopes.	Undulating alluvial fans and terraces that have mound microrelief.	Brown to reddish-brown gravelly sandy loam, slightly hard to hard, weak, fine, granular, slightly acid; yellowish-red sandy clay, very hard, massive, slightly acid; yellowish-red gravelly sandy loam, hard, massive, neutral.	Good______	Slow_________	Medium______
CyC	Corning gravelly sandy loam, 8 to 15 percent slopes.	Rolling (old dissected fans).	Brown to reddish-brown gravelly sandy loam, slightly hard to hard, weak, fine, granular, slightly acid; yellowish-red sandy clay, very hard, massive, slightly acid; yellowish-red gravelly sandy loam, hard, massive, neutral.	Good______	Slow_________	Rapid ______
CyD	Corning gravelly sandy loam, 15 to 30 percent slopes.	Hilly (old dissected fans); few shallow gullies.	Brown to reddish-brown gravelly sandy loam, slightly hard to hard, weak, fine, granular, slightly acid; yellowish-red sandy clay, very hard, massive, slightly acid; yellowish-red gravelly sandy loam, hard, massive, neutral.	Good______	Slow_________	Rapid________
DeA	Delhi loamy sand, 0 to 3 percent slopes.	Very gently undulating alluvial fans; slightly hummocky in places.	Pale-brown loamy sand, loose, single grain, neutral; pale-brown loamy sand, loose, single grain, neutral; same as subsoil or may be light yellowish brown.	Somewhat excessive.	Very rapid____	Very slow____
DeB	Delhi loamy sand, 3 to 8 percent slopes	Undulating old dunes and hummocks.	Pale-brown loamy sand, loose, single grain, neutral; pale-brown loamy sand, loose, single grain, neutral; same as subsoil or may be light yellowish brown.	Somewhat excessive.	Very rapid____	Slow________
DfA	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes.	Very gently sloping__	Pale-brown loamy sand, loose, single grain, neutral; pale-brown loamy sand, loose, single grain, neutral; brown clay, hard, blocky, neutral; resembles subsoil of Modesto loam.	Somewhat excessive.	Very rapid____	Very slow____
DgA	Delhi loamy sand, silty substratum, 0 to 3 percent slopes.	Very gently sloping__	Pale-brown loamy sand, loose, single grain, neutral; pale-brown loamy sand, loose, single grain, neutral; light-gray, stratified silt loam and very fine sand, compact, slightly hard, platy.	Somewhat excessive.	Very rapid____	Very slow ____

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	More than 6 feet	Moderate	Variable, 3 to 9.	Range	IIIe-4	Range; if leveled, deep-plowed, and protected from floods, field crops may be profitable; areas that are not too sandy should produce good yields.
Moderate	12 to 18 inches to slowly permeable subsoil.	Low	1 to 3	Range, dry-farmed grain.	IVe-3	Range, dry-farmed grain; crops respond to nitrogen and phosphorus together; in places the range has been improved by reseeding annual clovers and adding gypsum or single superphosphate, or both; in these places the increase in forage production is marked.
Moderate to high.	7 to 18 inches to slowly permeable subsoil.	Low	1 to 3	Range	IVe-3	Range and, if managed carefully, dry-farmed grain; yields and quality of forage can be improved by seeding clover and adding gypsum and phosphate.
High	6 to 9 inches to very slowly permeable subsoil.	Low	1 to 2	Range	VIe-9	Range; yields and quality of forage can be improved by seeding clover and adding gypsum and phosphate; not suited to grain; for control of further erosion, grazing should be carefully regulated.
High (wind erosion).	More than 6 feet	Moderate to low.	3 to 5	Grapes, melons, sweetpotatoes, alfalfa, almonds, and orchards.	IIIe-4	Grapes, orchards, melons, sweetpotatoes, alfalfa; soil must be irrigated in quick, light applications, using short runs, narrow checks, and a large head of water for a uniform application; nitrogen applied in small amounts two or more times during the growing season is best; zinc is needed for best yields of orchard crops; legumes respond to sulfur; sandburs and puncture vines are troublesome weeds; control of wind erosion needed for annual crops.
High (wind erosion).	More than 6 feet	Moderate to low.	3 to 5	Grapes, melons, sweetpotatoes, alfalfa, almonds, and orchards.	IIIe-4	Same as for Delhi loamy sand, 0 to 3 percent slopes, but if the soil is not leveled, sprinkler irrigation is advisable.
High (wind erosion).	36 to 48 inches over clay substratum.	Moderate to low.	2 to 4	Grapes, melons, sweetpotatoes, alfalfa, almonds, and orchards.	IIIe-4	Same as for Delhi loamy sand, 0 to 3 percent slopes, except that orchards are poorly suited, less frequent irrigation is needed, and overirrigation results in a temporary perched water table at depths of 3 to 4 feet, which may be harmful to deep-rooted crops.
High (wind erosion).	More than 6 feet	Moderate	5 to 7	Grapes, melons, sweetpotatoes, alfalfa, almonds, and orchards.	IIIe-4	Same as for Delhi loamy sand, 0 to 3 percent slopes, except that less frequent irrigation is needed.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
DhA	Delhi sand, 0 to 3 percent slopes.	Very gently undulating; hummocky in places.	Light brownish-gray sand, loose, single grain, neutral; light brownish-gray sand, loose, single grain, neutral; similar to subsoil but may be light yellowish brown in places.	Excessive	Very rapid	Very slow
DhB	Delhi sand, 3 to 8 percent slopes.	Undulating; hummocky in places.	Light brownish-gray sand, loose, single grain, neutral; light brownish-gray sand, loose, single grain, neutral; similar to subsoil but may be light yellowish brown in places.	Excessive	Very rapid	Slow
DkA	Dello loamy sand, 0 to 1 percent slopes.	Depressions and blowouts in areas of Delhi soils.	Grayish-brown sand, loose, single grain, neutral mottled bluish gray in many places; grayish-brown sand with mottles of strong brown and bluish gray; loose, single grain; light-gray sand or loamy sand with mottles of strong brown or bluish gray.	Imperfect to very poor.	Very rapid	Ponded
DmA	Dinuba fine sandy loam, 0 to 1 percent slopes.	Nearly level alluvial fans.	Gray fine sandy loam, slightly hard, massive, neutral to slightly acid; light brownish-gray, heavy fine sandy loam, mottled, slightly hard, massive, neutral, slightly calcareous; white, stratified silt loam and very fine sandy loam, mottled, platy, hard, calcareous.	Imperfect	Moderate	Very slow
DnA	Dinuba fine sandy loam, shallow, 0 to 1 percent slopes.	Nearly level alluvial fans.	Gray fine sandy loam, slightly hard, massive, neutral to slightly acid; light brownish-gray, heavy fine sandy loam, mottled, slightly hard, massive, neutral, slightly calcareous; white, stratified silt loam and very fine sandy loam, mottled, platy, hard, calcareous.	Imperfect	Moderate	Very slow
DoA	Dinuba fine sandy loam, deep, 0 to 1 percent slopes.	Nearly level alluvial fans.	Gray fine sandy loam, slightly hard, massive, neutral to slightly acid; light brownish-gray, heavy fine sandy loam, mottled, slightly hard, massive, neutral, slightly calcareous; white stratified silt loam and very fine sandy loam, mottled, platy, hard, calcareous.	Imperfect	Moderate	Very slow
DpA	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level fans	Gray fine sandy loam, hard, massive, moderately alkaline; mottled grayish-brown, heavy fine sandy loam, hard, massive, moderately alkaline; white, stratified silt loam, hard, brittle, platy, calcareous.	Imperfect	Slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
High (wind erosion).	More than 6 feet	Low	1 to 3	Orchards, grapes, melons, sweet-potatoes, alfalfa.	IVe–4	Same as for Delhi loamy sand, 0 to 3 percent slopes, except that even more frequent irrigation is needed.
High (wind erosion).	More than 6 feet	Low	1 to 3	Orchards, grapes, melons, sweet-potatoes, alfalfa.	IVe–4	Same as for Delhi loamy sand, 0 to 3 percent slopes, but even more frequent irrigation is needed; if the soil is not leveled, sprinkler irrigation is advisable.
None	Variable; 0 to 48 inches to water table.	Low	3 to 5	Pasture or irrigated pasture.	IVw–4	Irrigated pasture, orchards, and other deep-rooted crops can be grown if the soil is filled and drained; orchards do not do well for several years after leveling, probably because of conditions that result from decomposition of organic matter; water table is closest to the surface late in winter and in summer during peak of irrigation season.
Slight	Variable; 30 to 50 inches to silty substratum.	Moderate	6 to 8	Grapes, alfalfa, field crops, vegetables, melons.	IIw–3	Well suited to crops grown; not well suited to orchard crops; surface soil becomes very compact if worked when too moist; a perched water table forms if soil is overirrigated; grapes and stone fruits commonly require zinc.
Slight	12 to 24 inches to silty substratum.	Moderate	2 to 4	Field crops irrigated pasture.	IVs–3	Well suited to crops grown; not well suited to orchard crops; surface soil becomes very compact if worked when too moist; frequent, light irrigation needed; a perched water table forms if soil is overirrigated; grapes and stone fruits commonly require zinc; suited only to shallow-rooted crops.
Slight	42 to 60 inches to silty substratum.	Moderate	7 to 9	Grapes, alfalfa, field crops, melons, vegetables.	IIw–3	Same as for Dinuba fine sandy loam, 0 to 1 percent slopes, but fairly well suited to orchards if irrigated carefully.
Slight	Variable in short distances; 30 to 50 inches to unrelated silty substratum.	Low	5 to 7	Irrigated pasture, field crops.	IIw–3	Same as for Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes.

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TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
DrA	Dinuba sandy loam, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, slightly hard, massive, neutral to slightly acid; mottled light-grayish brown, heavy sandy loam, slightly hard, massive, neutral; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Moderate	Very slow
DsA	Dinuba sandy loam, shallow, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, slightly hard, massive, neutral to slightly acid; mottled light grayish-brown, heavy, sandy loam, slightly hard, massive, neutral; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Moderate	Very slow
DtA	Dinuba sandy loam, deep, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, slightly hard, massive, neutral to slightly acid; mottled light grayish-brown, heavy, sandy loam, slightly hard, massive, neutral; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Moderate	Very slow
DwA	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, slightly hard, massive, mildly alkaline; mottled grayish-brown, heavy sandy loam, hard, massive, moderately alkaline; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Slow	Very slow
DxA	Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, hard, massive, moderately alkaline, 25 to 50 percent of area saline-alkali; mottled grayish-brown, heavy sandy loam, hard, massive, moderately alkaline; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Very slow	Very slow
DyA	Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level fans	Grayish-brown sandy loam, hard, massive, neutral; mottled grayish-brown, heavy sandy loam, hard, massive, moderately alkaline; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Imperfect	Slow	Very slow
DuA	Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes	Depressions in nearly level plains.	Dark grayish-brown sandy loam mottled in places, slightly hard, massive, neutral; prominently mottled grayish-brown heavy sandy loam, slightly hard, massive, neutral, calcareous; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Poor	Moderate	Ponded

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	Variable in short distances; 30 to 50 inches to unrelated silty substratum.	Moderate	4 to 6	Alfalfa, field crops, melons, vegetables, irrigated pasture.	IIw-3	Well suited to crops grown; not well suited to orchards, although good yields are obtained where the water table is deep and management is good; soil tends to become compact if worked when too moist; a perched water table forms if soil is overirrigated; grapes and stone fruit commonly require zinc.
Slight	12 to 24 inches to silty substratum.	Moderate	2 to 3	Irrigated pasture, field crops.	IVs-3	Suited only to shallow-rooted crops; needs frequent, light irrigation; tends to compact if worked when too moist.
Slight	42 to 60 inches to silty substratum.	Moderate	5 to 8	Alfalfa, field crops, melons, vegetables, irrigated pasture.	IIw-3	Same as for Dinuba sandy loam, 0 to 1 percent slopes, but also fairly well suited to orchards if they are irrigated carefully, although there is a danger of sodium burn or lime chlorosis for sensitive crops, such as almonds or peaches.
Slight	Variable; 30 to 50 inches to silty substratum.	Low	4 to 6	Irrigated pasture, field crops.	IIw 3	Suited to crops grown; salts and alkali are present in local spots throughout the area; sensitive crops have spotty growth as well as sodium burn at edges of leaves, indicating phosphate and potash deficiency because of high pH; soil benefits greatly from improved drainage and salt and alkali reclamation; soil has a very strong tendency to become compact if worked when too moist.
Slight	Variable; 30 to 50 inches to silty substratum.	Low	3 to 5	Irrigated pasture, field crops.	IVs-8	Fairly well suited to irrigated trefoil pasture; reclamation by improving drainage, by using sulfur or gypsum, and by heavy irrigation is possible but may take several years; soil has a very strong tendency to become compact if worked when too moist.
Slight	12 to 24 inches to silty substratum.	Low	1 to 3	Irrigated pasture, field crops.	IVs-3	Fairly well suited to irrigated trefoil pasture; other crops would be suited if the soil is reclaimed; before attempting reclamation, soil should be subsoiled to a depth of at least 3 feet; soil has a very strong tendency to become compact if worked when too moist.
None	Variable; 30 to 50 inches to silty substratum or weak lime hardpan.	Low	4 to 6	Idle; irrigated pasture, field crops.	IIIw-3	Best suited to irrigated pasture; where adequate drainage can be provided, field crops can be grown, but yields are low for several years; soil has a very strong tendency to become compact if worked when too moist.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
DzA	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes.	Depressions in nearly level plains.	Gray sandy loam, mottled with strong brown or bluish gray, hard, massive, mildly to moderately alkaline; prominently mottled grayish-brown, heavy sandy loam, slightly hard, massive, neutral, calcareous; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Very poor	Slow	Ponded
Dl	Dredge and mine tailings.	Piles of gravel and cobbles.	Loose gravel and cobbles and a little sand; mottled grayish-brown, heavy sandy loam, hard, massive, moderately alkaline; white, stratified silt loam and very fine sandy loam, hard, platy, calcareous.	Excessive	Very rapid	None
EcF	Exchequer rocky loam, 30 to 60 percent slopes.	Steep uplands; 30 to 40 percent of area is rock outcrop.	Reddish-brown rocky loam, hard, massive, slightly acid, 30 to 40 percent of area is rock outcrop; none; hard greenstone that has nearly vertical bedding places.	Excessive	Moderate	Rapid to very rapid.
ErD	Exchequer and Auburn rocky soils, 8 to 30 percent slopes.	Rolling and hilly uplands, about 30 percent of area is rock outcrop.	Reddish-brown rocky loam, hard, massive, slightly acid; about 30 percent rock outcrop; about 30 percent of the area has a subsoil like that of Auburn clay loam; the rest has no subsoil; hard greenstone that has nearly vertical bedding planes.	Good to somewhat excessive.	Moderate	Medium to rapid.
ExB	Exchequer and Auburn soils, 3 to 8 percent slopes.	Ridgetops and swales in hilly uplands; occasional rock outcrop.	Reddish-brown rocky loam, hard, massive, slightly acid; an occasional rock outcrop; about 50 percent of the area has a subsoil like that of Auburn clay loam; the rest has no subsoil; hard greenstone that has nearly vertical bedding planes.	Good	Moderate	Slow to medium.
ExD	Exchequer and Auburn soils, 8 to 30 percent slopes.	Rolling and hilly uplands, about 10 percent of area is rock outcrop.	Reddish-brown rocky loam, hard, massive, slightly acid; about 10 percent rock outcrop; about 40 percent of the area has a subsoil like that of Auburn clay loam; the rest has no subsoil; hard greenstone that has nearly vertical bedding planes.	Good to somewhat excessive.	Moderate	Medium to rapid.
FoA	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes.	Oxbow depressions in flood plains.	Mottled dark grayish-brown very fine sandy loam, soft, weak granular calcareous, saline-alkali in spots; similar to surface soil but prominently mottled, stratified with sandy layers; similar to surface soil but prominently mottled, stratified with sandy layers.	Very poor	Moderate	Ponded
FpA	Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor, subject to a fluctuating high water table; hogwallow relief in places.	Light brownish-gray fine sandy loam, slightly hard, platy, neutral to moderately alkaline; grayish-brown sandy clay loam, very hard, prismatic, strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Very slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
None	Variable; 30 to 50 inches to hardpan.	Low	3 to 5	Mainly idle	IIIw-6	Pasture; some areas of this soil have been leveled at considerable expense, but several years are usually necessary before they become as productive as the surrounding soils; soil has a very strong tendency to become compact if worked when too moist.
None	More than 6 feet	Very low	Less than 1	Idle	VIIIs-1	Not suited to crops; yield a little forage in places.
High	2 to 16 inches to hard rock.	Low	1 to 2	Range	VIIe-3	Range; not suitable for reseeding; careful grazing management necessary to control erosion.
Slight to moderate.	6 to 20 inches to hard rock.	Low to moderate.	1 to 4	Range	VIIe-3	Range; not suitable for reseeding.
Slight	6 to 24 inches to hard rock.	Low to moderate.	1 to 5	Range	VIe-3	Range; suitable for reseeding.
Slight to moderate.	6 to 20 inches to hard rock.	Low to moderate.	1 to 4	Range	VIe-3	Range; suitable for reseeding.
None	Variable; water table at 0 to 36 inches.	Low	2½ per foot of soil above water table.	Pasture or idle	IIIw-6	Pasture; drainage is difficult because of low position; farmers often find it worthwhile to cover this soil with Grangeville soil material.
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	0 to 1 (4 to 7 for salt-tolerant plants).	Range, irrigated pasture.	IIIs-8	Range, irrigated pasture, shallow-rooted, alkali-tolerant crops; deep-rooted crops, such as orchard crops are not suited; reclamation is moderately difficult; even after the surface soil is freed of sodium, it is easily dispersed and compacted.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
FrA	Fresno fine sandy loam, moderately saline-alkaki, 0 to 1 percent slopes.	Nearly level valley floor subiect to a fluctuating high water table; hog-wallow relief in places.	Light brownish-gray fine sandy loam, slightly hard, platy, neutral to strongly alkaline; grayish-brown sandy clay loam, very hard, prismatic, strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Very slow	Very slow
FsA	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subiect to a fluctuating high water table; hog-wallow relief in places.	Light brownish-gray fine sandy loam, slightly hard, platy, mildly to strongly alkaline; grayish-brown sandy clay loam, very hard, prismatic, strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Very slow	Very slow
FtA	Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subiect to a fluctuating high water table; hog-wallow relief in places.	Light brownish-gray sandy loam, slightly hard, platy, neutral to moderately alkaline; grayish-brown sandy clay loam, very hard, prismatic, strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Slow to very slow.	Very slow
FuA	Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subject to a fluctuating high water table; hog-wallow relief in places.	Light brownish-gray sandy loam, slightly hard, platy, neutral to strongly alkaline; grayish-brown sandy clay loam, very hard, prismatic, very strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Slow to very slow.	Very slow
FvA	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subject to a fluctuating high water table; hog-wallow relief in places.	Light brownish-gray sandy loam, slightly hard, platy, mildly to strongly alkaline; grayish-brown sandy clay loam, very hard, prismatic, very strongly alkaline, calcareous; light-gray, lime-silica cemented hardpan overlying light-gray loam, massive, hard, strongly alkaline, calcareous.	Imperfect	Very slow	Very slow
FwA	Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subject to a fluctuating high water table; hog-wallow relief in places.	For profile description of soils in this complex, see Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes, and Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Imperfect	Slow and very slow.	Very slow
FxA	Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor subject to a fluctuating high water table; hog-wallow relief in places.	For profile description of soils in this complex, see Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes, and Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Imperfect	Slow and very slow.	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	0 to 1 (4 to 7 for salt-tolerant plants).	Range and irrigated saltgrass or trefoil pasture.	IVs–8	Range and irrigated saltgrass or trefoil pasture; reclamation is very difficult; otherwise same as for Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	1 to 3 for salt-tolerant plants only.	Range or idle	VIs–8	Range; a few areas are irrigated by wild flooding; reclamation is extremely difficult.
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	0 to 1 (3 to 5 for salt-tolerant plants).	Range and irrigated pasture.	IIIs–8	Range, irrigated pasture, shallow-rooted, alkali-tolerant crops; deep-rooted crops such as orchard crops are not suited; fairly easy to reclaim; leaching, while growing irrigated pasture, will remove most of the surface sodium in 5 to 10 years.
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	0 to 1 (3 to 5 for salt-tolerant plants).	Range and irrigated saltgrass and trefoil pasture.	IVs–8	Range, irrigated saltgrass, and trefoil pasture; reclamation difficult.
Slight	0 to 10 inches to strongly alkaline layer; 24 to 40 inches to hardpan.	Low	1 to 2 for salt-tolerant plants only.	Range and idle	VIs–8	Range; few areas irrigated by wild flooding; reclamation very difficult.
Slight	0 to 20 inches to strongly alkaline layer; 24 to 48 inches to hardpan or compact silt.	Low	0 to 4 (3 to 6 for salt-tolerant plants).	Irrigated pasture	IIIs–8	Irrigated pasture; reclamation moderately difficult.
Slight	0 to 20 inches to strongly alkaline layer; 24 to 48 inches to hardpan or compact silt.	Low	0 to 4 (3 to 6 for salt-tolerant plants).	Irrigated pasture	IVs–8	Irrigated pasture; reclamation difficult.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
GfA	Grangeville fine sandy loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Grayish-brown fine sandy loam, soft, weak granular, mildly alkaline; grayish-brown fine sandy loam, mottled, soft, weak granular; generally mildly alkaline but calcareous in places; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderately rapid.	Very slow
GgA	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Grayish-brown fine sandy loam, soft, weak granular, mildly alkaline; grayish-brown fine sandy loam, mottled, soft, weak granular; generally mildly alkaline but calcareous in places; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderately rapid.	Very slow
GhA	Grangeville sandy loam, 0 to 1 percent slopes.	Narrow streaks and very low ridges at the edges of alluvial fans.	Brown to grayish-brown sandy loam, soft, massive, neutral; brown to grayish-brown sandy loam, soft, massive, neutral; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderately rapid.	Very slow
GkA	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Narrow streaks and very low ridges at the edges of alluvial fans.	Brown to grayish-brown sandy loam, soft, massive, neutral; brown to grayish-brown sandy loam, soft, massive, neutral; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderate	Very slow
GmA	Grangeville very fine sandy loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Grayish-brown very fine sandy loam, soft, weak granular, mildly alkaline; similar to surface soil but mottled and calcareous in numerous places; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderate	Very slow
GnA	Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Very shallow depressions in flood plains; occasional flooding.	Grayish-brown very fine sandy loam, soft, weak granular, mildly alkaline; similar to surface soil but mottled and calcareous in numerous places; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderate	Very slow
GoA	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Very shallow depressions in flood plains; occasional flooding.	Grayish-brown very fine sandy loam, soft, weak granular, mildly alkaline; similar to surface soil but mottled and calcareous in numerous places; similar to subsoil but faintly mottled and calcareous.	Imperfect	Moderate	Very slow
GrA	Greenfield fine sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial terraces.	Light brownish-gray fine sandy loam, slightly hard, massive, neutral; brown fine sandy loam, hard, weak blocky, neutral; pale-brown sandy loam, massive, stratified with silt loam in places, neutral.	Good	Moderate	Very slow
GsA	Greenfield sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial terraces.	Light brownish-gray fine sandy loam, soft, massive, neutral; brown sandy loam, hard, weak blocky, neutral; pale-brown sandy loam, massive, stratified with silt loam in places, neutral.	Good	Moderately rapid.	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	More than 6 feet	High	6 to 9	Alfalfa, truck and field crops, some orchards.	IIw-2	Well suited to alfalfa and truck and field crops; fairly well suited to orchards; serious weed problems, particularly with johnsongrass and bermudagrass.
Slight	More than 6 feet	Moderate	6 to 9	Alfalfa, field crops.	IIw-2	Well suited to alfalfa and field crops; improved drainage and reclamation by flooding needed during periods when water table is low; serious weed problems.
Slight	More than 6 feet	Moderate	5 to 8	Grapes, irrigated pasture, field crops.	IIw-2	Well suited to grapes, irrigated pasture, and field crops; not well suited to orchards; weed problem less serious than on other Grangeville soils nearby.
Slight	More than 6 feet	Moderate	4 to 7	Irrigated pasture	IIw-2	Well suited to pasture and field crops; removal of the excess salts and alkali fairly easy if good drainage can be established.
Slight	More than 6 feet	High	8 to 10	Alfalfa, truck crops, some orchards.	IIw-2	Same as for Grangeville fine sandy loam, 0 to 1 percent slopes.
Slight	More than 6 feet	High	8 to 10	Alfalfa, field crops	IIw-2	Same as for Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
Slight	More than 6 feet	Low	6 to 8	Pasture	IIIw-6	Suitable only for pasture unless reclaimed; reclamation is moderately difficult; deep drainage ditches are needed but are difficult or impossible to install because of lack of suitable outlets.
Slight	More than 6 feet	Moderate to high.	9 to 11	Alfalfa, grapes, orchard, field, and truck crops.	I-1	Well suited to a wide variety of crops; peaches, almonds, and grapes respond to applications of zinc; all crops except legumes respond to applications of nitrogen; legumes respond to applications of sulfur; soil tends to become compact if worked when too moist.
Slight	More than 6 feet	Moderate to high.	7 to 10	Alfalfa, grapes, orchard, field, and truck crops.	I-1	Same as for Greenfield fine sandy loam, 0 to 3 percent slopes, but soil has less tendency to become compact.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
GsB	Greenfield sandy loam, 3 to 8 percent slopes.	Gently sloping alluvial terraces.	Light brownish-gray fine sandy loam, soft, massive, neutral; brown sandy loam, hard, weak blocky, neutral; pale-brown sandy loam, massive, stratified with silt loam in places, neutral.	Good	Moderately rapid.	Slow
GvA	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial fans.	Light brownish-gray fine sandy loam, soft, massive, neutral; brown sandy loam, hard, weak, blocky, neutral; pale-brown sandy loam, massive, stratified with silt loam in places, neutral, overlying unrelated hardpan of buried Madera or San Joaquin soil.	Good	Moderately rapid.	Very slow
HbA	Hanford fine sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial fans.	Pale-brown to brown fine sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish brown fine sandy loam, soft, massive, neutral; similar to subsoil.	Good	Moderately rapid.	Very slow
HbmA	Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial fans.	Pale-brown to brown fine sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown fine sandy loam, soft, massive, neutral; white sand speckled with black grains and mica, single grain, loose, neutral.	Somewhat excessive.	Moderately rapid.	Very slow
HbpA	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes.[1]	Nearly level to very gently sloping alluvial fans.	Pale-brown to brown fine sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown fine sandy loam, soft, massive, neutral; white silt loam and very fine sandy loam, stratified, slightly hard, massive, neutral.	Good	Moderately rapid.	Very slow
HbsA	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes.[1]	Nearly level to very gently sloping alluvial fans.	Pale-brown to brown fine sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown fine sandy loam, soft, massive, neutral; white silt loam and very fine sandy loam, stratified, slightly hard, massive, neutral.	Good	Moderately rapid.	Very slow
HcA	Hanford gravelly sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping low benches, 10 to 15 feet above flood plains.	Pale-brown to brown fine sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown gravelly sandy loam, soft, massive, neutral; similar to subsoil.	Somewhat excessive.	Rapid	Very slow
HdA	Hanford sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial fans.	Pale-brown to brown sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral, similar to subsoil.	Good	Rapid	Very slow
HdB	Hanford sandy loam, 3 to 8 percent slopes.	Gently sloping terrace edges.	Pale-brown to light yellowish-brown sandy loam, massive, neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral; similar to subsoil.	Good	Rapid	Slow

[1] See footnote 1, page 42.

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	More than 6 feet	Moderate to high.	7 to 10	Alfalfa, grapes, orchard, field, and truck crops.	IIe–1	Same as for Greenfield fine sandy loam, 1 to 3 percent slopes, but requires contour furrow or sprinkler irrigation.
Slight	38 to 54 inches to unrelated hardpan.	Moderate to high.	5 to 7	Alfalfa, grapes, orchard, field, and truck crops.	IIs–3	Same as for Greenfield fine sandy loam, 0 to 3 percent slopes, but deep-rooted crops, such as walnuts, are not well suited; must be irrigated carefully to prevent a perched water table.
Slight	More than 6 feet	High	7 to 10	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Well suited to crops grown; soil has a strong tendency to become compact if worked when too moist; few spots where zinc is deficient; nitrogen needed for best yield of most crops except legumes.
Slight	20 to 36 inches to clean sand.	Moderate	4 to 6	Alfalfa, range	IIIs–4	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but best suited to shallow-rooted crops; requires frequent, light irrigation.
Slight	Highly variable; 24 to 54 inches to compact silt.	High	6 to 9	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but overirrigation should be carefully avoided on orchard crops.
Slight	Variable but averages 48 to 60 inches to compact silt.	High	7 to 10	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but overirrigation should be carefully avoided on orchard crops.
Slight	More than 6 feet	Moderate	3 to 5	Field crops, alfalfa.	IIIs–4	Well suited to field crops, alfalfa, orchards, and grapes; requires rather frequent, light irrigation.
Slight	More than 6 feet	Moderate to high.	5 to 7	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but has only a moderate tendency to become compact if worked when too moist.
Slight	More than 6 feet	Moderate to high.	5 to 7	Alfalfa, grapes, orchard, truck, and field crops.	IIe–1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but has only a moderate tendency to become compact if worked when too moist and requires contour furrow or sprinkler irrigation to control erosion.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
HdC	Hanford sandy loam, 8 to 15 percent slopes.	Sloping terrace edges.	Pale-brown to light yellowish-brown sandy loam, massive, neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral; similar to subsoil.	Good	Rapid	Slow to medium.
HddA	Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes.	Depressions in alluvial fans.	Grayish-brown sandy loam, slightly hard, massive, neutral; grayish-brown sandy loam, massive, neutral; similar to subsoil but mottled with light gray or strong brown.	Poor	Rapid	Ponded
HdmA	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes.	Nearly level to gently sloping alluvial flood plains.	Pale-brown sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral; light brownish-gray sand, loose, single grain, neutral.	Somewhat excessive.	Rapid	Very slow
HdpA	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes.[1]	Nearly level alluvial fans.	Light brownish-gray to pale-brown sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral; white, stratified silt loam and fine sandy loam, massive, hard, neutral.	Good	Rapid	Very slow
HdsA	Hanford sandy loam, deep over silt, 0 to 1 percent slopes.[1]	Nearly level alluvial fans.	Light brownish-gray to pale-brown sandy loam, slightly hard, massive, slightly acid to neutral; pale-brown to light yellowish-brown sandy loam, massive, neutral; white, stratified silt loam and fine sandy loam, massive, hard, neutral.	Good	Rapid	Very slow
HeA	Hanford very fine sandy loam, 0 to 1 percent slopes.	Nearly level flood plains that are occasionally flooded.	Brown very fine sandy loam, soft, weak granular, neutral; pale-brown to light yellowish-brown very fine sandy loam, massive, neutral; similar to subsoil.	Good	Moderate	Very slow
HfA	Hilmar loamy sand, 0 to 1 percent slopes.	Nearly level alluvial fans that have small hummocky areas.	Light brownish-gray loamy sand, soft, massive, slightly acid to neutral; similar to surface soil but mottled and calcareous; light-gray, stratified silt loam and sandy loam, platy, hard, strongly calcareous.	Imperfect	Very rapid	Very slow
HfdA	Hilmar loamy sand, deep, 0 to 1 percent slopes.	Nearly level alluvial fans that have small hummocky areas.	Light brownish-gray loamy sand, soft, massive, slightly acid to neutral; similar to surface soil but mottled and calcareous; light-gray, stratified silt loam and sandy loam, platy, hard, strongly calcareous.	Imperfect	Very rapid	Very slow

[1] This soil was described under the series name "Ripperdan" in University of California Soil Survey Report No. 13, Soils of Eastern Stanislaus County, California (*3*), and in some other University of California publications.

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Moderate	More than 6 feet	Moderate to high.	5 to 7	Grapes, orchard, pasture.	IVe 1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but has only a moderate tendency to become compact if worked when too moist and needs irrigation by contour furrows or sprinklers and contour planting and cultivation to control erosion.
None	More than 6 feet	Moderate	5 to 7	Pasture, field crops.	IIw–2	Fairly well suited to crops grown; difficult to drain except with drainage pumps; can be covered in leveling so that there is ample thickness of well-drained soil.
Slight	24 to 36 inches to clean sand.	Moderate	3 to 4	Alfalfa, truck crops, range.	IIIs–4	Same as for Hanford fine sandy loam, 0 to 3 percent slopes, but has only a slight tendency to become compact and is well suited to shallow-rooted crops, but poorly suited to deep-rooted crops; also, it requires frequent, light irrigation.
Slight	Highly variable; 30 to 54 inches to compact slowly permeable silt.	Moderate to high.	4 to 7	Alfalfa, grapes, orchard, truck, and field crops.	IIs–3	Same as for Hanford fine sandy loam, 0 to 3 percent slopes; silty substratum impedes penetration of roots and water slightly.
Slight	Averages 48 to 60 inches to compact slowly permeable silt.	Moderate to high.	7 to 8	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Same as for Hanford fine sandy loam, 0 to 3 percent slopes; silty substratum impedes penetration of roots and water only slightly.
Slight	More than 6 feet	High	8 to 10	Alfalfa, grapes, orchard, truck, and field crops.	I–1	Well suited to crops grown; strong tendency to become compact if worked when too moist; nitrogen needed for best yield of most crops except legumes.
Moderate (wind erosion).	Highly variable; 24 to 60 inches to compact silt or hardpan.	Low	1 to 3	Alfalfa, pasture, field crops, grapes, sweet-potatoes, few orchards.	IIIw–4	Poorly suited to orchards; fairly well suited to the other crops grown; grapes and orchard crops sometimes show evidence of zinc deficiency or sodium burn; frequent, light applications of water, coupled with area-wide drainage, needed to prevent the water table from rising.
Moderate (wind erosion).	42 to 60 inches to compact silt or hardpan.	Low	2 to 3	Alfalfa, pasture, field crops, grapes, few orchards, sweet-potatoes.	IIIw–4	Same as for Hilmar loamy sand, 0 to 1 percent slopes; poorly suited to orchard crops and fairly well suited to the other crops grown.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
HkbA	Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level alluvial fans.	Light brownish-gray loamy sand, soft, massive, neutral; similar to surface soil but mottled and calcareous; light-gray, stratified silt loam and sandy loam, hard, platy, strongly calcareous.	Imperfect	Very rapid	Very slow
HfeA	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes.	Depressions in nearly level alluvial fans.	Mottled grayish-brown loamy sand, soft, massive, neutral, calcareous in spots; similar to surface soil; light-gray, stratified silt loam and sandy loam, hard, platy, strongly calcareous.	Very poor	Very rapid	Ponded
HkaA	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes.	Depressions in nearly level alluvial fans.	Grayish-brown loamy sand, soft, massive, neutral, similar to surface soil but mottled and calcareous; light-gray, stratified silt loam and sandy loam, hard, platy, strongly calcareous.	Poor	Very rapid	Ponded
HmA	Hilmar sand, 0 to 3 percent slopes	Nearly level, very gently undulating fans, some hummocky areas.	Light brownish-gray sand, loose, single grain, slightly acid or neutral; similar to surface soil but mottled and calcareous; light-gray, stratified silt loam and sandy loam, hard, platy, strongly calcareous.	Imperfect	Very rapid	Very slow
HnA	Honcut clay loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Brown clay loam, hard, weak blocky, neutral; similar to surface soil but massive; brown loam, hard, massive, slightly acid to neutral.	Good	Moderately slow.	Very slow
HoA	Honcut fine sandy loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Brown fine sandy loam, slightly hard, massive, neutral; similar to surface soil; brown sandy loam, slightly hard, slightly acid to neutral.	Good	Moderately rapid.	Very slow
HpA	Honcut loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Brown loam, hard, weak blocky, neutral; similar to surface soil but massive; brown sandy loam, slightly hard, slightly acid to neutral.	Good	Moderate	Very slow
HrA	Honcut sandy loam, 0 to 1 percent slopes.	Nearly level flood plains; occasional flooding.	Brown sandy loam, slightly hard, massive, neutral; similar to surface soil; brown sandy loam, slightly hard, slightly acid to neutral.	Good	Rapid	Very slow
HsB	Hopeton clay, 3 to 8 percent slopes.	Gently sloping or undulating alluvial fans.	Dark-gray to dark-brown clay, blocky, very hard, slightly acid; dark-gray clay, very hard, prismatic and blocky, mildly alkaline, calcareous in lower part; light-gray sandstone, weakly consolidated.	Good	Very slow	Slow to medium.
HtA	Hopeton clay loam, 0 to 3 percent slopes.	Very gently sloping	Dark-gray to dark-brown blocky clay loam, hard, slightly acid; dark-gray clay, very hard, prismatic and blocky, mildly alkaline, calcareous in lower part; light-gray sandstone, weakly consolidated.	Good	Slow	Very slow to slow.
HtB	Hopeton clay loam, 3 to 8 percent slopes.	Gently sloping or undulating.	Dark-gray to dark-brown blocky clay loam, hard, slightly acid; dark-gray clay, very hard, prismatic and blocky, mildly alkaline, calcareous in lower part; light-gray sandstone, weakly consolidated.	Good	Slow	Slow to medium.

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Moderate (wind erosion).	Highly variable; 24 to 60 inches to compact silt or hardpan.	Low	1 to 3	Pasture, alfalfa, field crops.	IIIw-4	Fairly well suited to crops grown; salts and alkali can be removed with normal irrigation if drainage is provided and gypsum added.
None	24 to 36 inches to hardpan.	Low	1 to 2	Pasture	IVw-4	Well suited to pasture; poorly suited to cultivated crops; reclamation is difficult because of lack of suitable drainage outlets and seepage from surrounding fields.
None	12 to 36 inches to water table, hardpan at 24 to 48 inches.	Low	1 to 2	Pasture	IVw-4	Same as for Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes.
High (wind erosion).	Highly variable; 24 to 60 inches to compact silt or hardpan.	Low	½ to 2	Alfalfa, pasture, field crops, grapes, sweetpotatoes.	IIIw-4	Same as Hilmar loamy sand, 0 to 1 percent slopes, except that this soil requires more frequent irrigation and has lower yields.
Slight	More than 6 feet	High	9 to 11	Orchard crops, alfalfa, field crops, pasture.	I-1	Well suited to crops grown; strong tendency to become compact if worked when too moist.
Slight	More than 6 feet	High	7 to 10	Orchard crops, alfalfa, field crops, pasture, grapes, truck crops.	I-1	Same as for Honcut clay loam, 0 to 1 percent slopes, but has only a moderate tendency to become compact if worked when too moist.
Slight	More than 6 feet	High	9 to 11	Orchard crops, alfalfa, field crops, pasture, grapes, truck crops.	I-1	Same as for Honcut clay loam, 0 to 1 percent slopes, but has only a moderate tendency to become compact if worked when too moist.
Slight	More than 6 feet	Moderate	5 to 8	Orchard crops, alfalfa, field crops, pasture, grapes, truck crops.	I-1	Same as for Honcut clay loam, 0 to 1 percent slopes, but has only a very slight tendency to become compact; subject to occasional winter floods of short duration.
Slight	24 to 40 inches to weakly consolidated sandstone.	Moderate	6 to 10	Dry-farmed grain, range, irrigated pasture	IIIs-5	Well suited to crops grown; water should be applied very slowly in irrigation areas because of very slow permeability.
Slight	24 to 40 inches to weakly consolidated sandstone.	Moderate	6 to 10	Dry-farmed grain, range, irrigated pasture.	IIIs-3	Well suited to crops grown; water should be applied slowly in irrigated areas.
Slight	24 to 40 inches to weakly consolidated sandstone.	Moderate	6 to 10	Dry-farmed grain, range, irrigated pasture.	IVe-3	Well suited to crops grown; water should be applied very slowly to control erosion on irrigated areas.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
HuA	Hopeton loam, 0 to 3 percent slopes.	Very gently sloping	Dark-gray to dark-brown blocky clay loam, hard, slightly acid; dark-gray clay, very hard, prismatic and blocky, mildly alkaline, calcareous in lower part; light-gray sandstone, weakly consolidated.	Good	Slow	Very slow to slow.
HuB	Hopeton loam, 3 to 8 percent slopes.	Gently sloping or undulating.	Dark-gray to dark-brown blocky clay loam, hard, slightly acid; dark-gray clay, very hard, prismatic and blocky, mildly alkaline, calcareous in lower part; light-gray sandstone, weakly consolidated.	Good	Slow	Slow
HvB	Hornitos fine sandy loam, 3 to 8 percent slopes.	Undulating uplands that have mound microrelief.	Pale-brown to light reddish-brown fine sandy loam, massive, slightly hard, medium acid; none; white to reddish-yellow quartz sandstone, moderately consolidated.	Good	Moderately rapid.	Slow to medium.
HvD	Hornitos fine sandy loam, 8 to 30 percent slopes.	Rolling to hilly uplands that have scattered rock outcrops.	Pale-brown to light reddish-brown fine sandy loam, massive, slightly hard, medium acid; none; white to reddish-yellow quartz sandstone, moderately consolidated.	Somewhat excessive.	Moderately rapid.	Medium to rapid.
HyB	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes.	Undulating uplands that have mound microrelief.	Pale-brown to light reddish-brown fine sandy loam, massive, slightly hard, medium acid; none; white to reddish-yellow quartz sandstone, moderately consolidated.	Good	Moderately rapid.	Slow to medium.
HyD	Hornitos gravelly fine sandy loam, 8 to 30 percent slopes.	Rolling to hilly uplands that have scattered rock outcrops.	Pale-brown to light reddish-brown fine sandy loam, massive, slightly hard, medium acid; none; white to reddish-yellow quartz sandstone, moderately consolidated.	Somewhat excessive.	Moderately rapid.	Medium to rapid.
KeB	Keyes cobbly clay loam, 0 to 8 percent slopes.	Undulating high terraces that have mound microrelief.	Grayish-brown cobbly clay loam, hard, massive, medium acid; grayish-brown gravelly clay, hard, slightly acid; yellowish-brown hardpan overlying bluish-gray beds of andesitic sand, gravel, and tuff beds.	Good	Very slow	Very slow to medium.
KgB	Keyes gravelly clay loam, 0 to 8 percent slopes.	Undulating high terraces that have mound microrelief.	Grayish-brown cobbly clay loam, hard, massive, medium acid; grayish-brown gravelly clay, hard, slightly acid; yellowish-brown hardpan overlying bluish-gray beds of andesitic sand, gravel, and tuff beds.	Good	Very slow	Very slow to medium.
La	Lava and sandstone rockland.	Small sandstone buttes and lava flows.	Scabby jumbles of rock			
MaA	Madera loam, 0 to 2 percent slopes.	Very gently undulating old fans that have mound microrelief in unleveled areas.	Brown loam, hard, massive, neutral; reddish-brown sandy clay to clay, very hard, blocky, neutral to mildly alkaline; brown, indurated hardpan overlying yellowish-brown sandy loam, very hard, massive, mildly alkaline.	Good	Very slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	24 to 40 inches to weakly consolidated sandstone.	Moderate	6 to 10	Dry-farmed grain, range, irrigated pasture.	IIIs–3	Same as for Hopeton clay loam, 0 to 3 percent slopes.
Slight	24 to 40 inches to weakly consolidated sandstone.	Moderate	6 to 10	Dry-farmed grain, range, irrigated pasture.	IVe–3	Same as for Hopeton clay loam 3 to 8 percent slopes.
Slight to moderate.	3 to 14 inches to bedrock.	Very low	½ to 1½	Range	VIIe–9	Range; not suitable for reseeding; carrying capacity is low.
High	3 to 12 inches to bedrock.	Very low	½ to 1	Range	VIIe–9	Range; not suitable for reseeding; carrying capacity is low.
Slight to moderate.	3 to 14 inches to bedrock.	Very low	¼ to 1	Range	VIIe–9	Same as for Hornitos fine sandy loam, 3 to 8 percent slopes, but carrying capacity very low.
High	3 to 12 inches to bedrock.	Very low	¼ to 1	Range	VIIe–9	Same as for Hornitos fine sandy loam, 3 to 8 percent slopes, but carrying capacity very low.
Slight	10 to 20 inches to hardpan.	Low	2 to 4	Range	VIe–9	Suitable for range; reseeding is difficult because of cobbles, which are concentrated in patches between the mounds.
Slight	10 to 20 inches to hardpan.	Low	2 to 4	Range, irrigated pasture, dry-farmed grain.	IVe–3	Suitable for range and pasture; poorly suited to cultivated crops; range improvement by fertilizing and reseeding is feasible.
				Included in range	VIIIs–1	Little or no agricultural value; sandstone quarried in places for building stone.
Slight	18 to 40 inches to hardpan.	Low	3 to 5	Mainly irrigated pasture and field crops, few vineyards and orchards.	IVs–3	Well suited to pasture, fairly well suited to field crops, poorly suited to orchards and vineyards; careful irrigation necessary to prevent a perched water table from forming; soil has a strong tendency to compact if worked when too moist.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
MdA	Madera sandy loam, 0 to 2 percent slopes.	Very gently undulating old fans that have mound microrelief in unleveled areas.	Brown loam, hard, massive, neutral; reddish-brown sandy clay to clay, very hard, blocky, neutral to mildly alkaline; brown, indurated hardpan overlying yellowish-brown sandy loam, very hard, massive, mildly alkaline.	Good	Very slow	Very slow
MdB	Madera sandy loam, 2 to 4 percent slopes.	Gently undulating old fans.	Brown loam, hard, massive, neutral; reddish-brown sandy clay to clay, very hard, blocky, neutral to mildly alkaline; brown, indurated hardpan overlying yellowish-brown sandy loam, very hard, massive, mildly alkaline.	Good	Very slow	Slow
MeA	Madera-Alamo complex, 0 to 2 percent slopes.	Gently sloping fans that have scattered, small depressions.	For profile descriptions of soils of this complex, see Madera sandy loam, 0 to 2 percent slopes, and Alamo clay, 0 to 2 percent slopes; (complex consists of about 30 percent Alamo clay in small bodies within areas of Madera sandy loam).	Good (Madera); poor (Alamo).	Very slow	Very slow (Madera); ponded (Alamo).
MkA	Meikle clay, 0 to 1 percent slopes.	Shallow, level basins; ponded in wet years.	Mottled gray sandy clay loam over dark-gray clay, thin (1 to 4 inches), very hard, blocky, neutral; dark grayish-brown clay, very hard, blocky calcareous; pale-brown sandy loam or loam, slightly hard, massive, mildly alkaline.	Imperfect	Very slow	Ponded
MmA	Modesto clay loam, 0 to 1 percent slopes.	Nearly level valley floor.	Grayish-brown clay loam, very hard, massive, slightly acid to neutral; brown clay, very hard, blocky and prismatic, mildly alkaline, slightly calcareous; brown sandy loam, hard, massive, in places light-gray silt loam weakly cemented with lime.	Moderately good.	Slow to very slow.	Very slow
MnA	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor.	Grayish-brown clay loam, very hard, massive, slightly acid to neutral; brown clay, very hard, blocky and prismatic, moderately alkaline, slightly calcareous; brown sandy loam, hard, massive, in places light-gray silt loam weakly cemented with lime.	Moderately good.	Very slow	Very slow
MoA	Modesto loam, 0 to 1 percent slopes.	Nearly level valley floor.	Grayish-brown loam, very hard, massive, slightly acid to neutral; brown clay, very hard, blocky, mildly alkaline, slightly calcareous; brown sandy loam, hard, massive, in places light-gray silt loam weakly cemented with lime.	Moderately good.	Slow	Very slow
MpA	Modesto loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level valley floor.	Grayish-brown loam, very hard, massive, slightly acid to neutral; brown clay, very hard, blocky, or prismatic, moderately alkaline, calcareous; brown sandy loam, hard, massive, in places light-gray silt loam weakly cemented with lime.	Moderately good.	Very slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	18 to 40 inches to hardpan.	Low	2 to 4	Mainly irrigated pasture and field crops, few vineyards and orchards.	IVs 3	Same as for Madera loam, 0 to 2 percent slopes, but has only a moderate tendency to become compact if worked when too moist.
Slight	18 to 40 inches to hardpan.	Low	2 to 4	Mainly irrigated pasture and field crops, few vineyards and orchards.	IVe–3	Same as for Madera loam, 0 to 2 percent slopes, but has only a moderate tendency to become compact if worked when too moist; also, irrigation by sprinklers or by contour furrows is advisable on row crops.
Slight (Madera); none (Alamo).	14 to 40 inches to hardpan.	Low	3 to 5	Dry-farmed grain, range, irrigated pasture.	IVs–3	Fairly well suited to crops grown; some areas are difficult to manage because the soils dry out at greatly different rates.
None	More than 6 feet	Low	10 to 12	Dry-farmed grain, range; irrigated pasture where external drainage has been established.	IIIw–5	Fairly well suited to crops grown; in wet years the soil is ponded most of the summer unless drainage is provided; used for grain in dry years and grazed or left idle in wet years; difficult to work.
Slight	36 to 72 inches	Moderate	6 to 10	Grapes, orchards, pasture, field crops, alfalfa.	IIs–7	Well suited to pasture; fairly well suited to other crops grown; soil has a very strong tendency to become compact if worked when too moist, and compacted areas are difficult to restore to good tilth.
Slight	36 to 72 inches	Low	4 to 8	Irrigated pasture, alfalfa, field crops.	IIs–6	Same as for Modesto clay loam, 0 to 1 percent slopes; reclamation is slow.
Slight	36 to 72 inches	Moderate	5 to 9	Grapes, orchards, pasture, field crops, alfalfa.	IIs–7	Same as for Modesto clay loam, 0 to 1 percent slopes, but slightly less likely to become compact.
Slight	36 to 72 inches	Low	3 to 7	Irrigated pasture, alfalfa, field crops.	IIs–6	Same as for Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
MtA	Montpellier coarse sandy loam, 0 to 3 percent slopes.	Gently undulating high old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid; reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Very slow
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes.	Undulating, high, old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid; reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Slow
MtC	Montpellier coarse sandy loam, 8 to 15 percent slopes.	Rolling, dissected areas on high, old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid; reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Slow to medium.
MtC2	Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded.	Rolling, dissected areas on high, old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid; reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Medium
MtD2	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded.	Hilly, dissected areas on old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid; reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Rapid
MtD3	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded.	Hilly, dissected areas on old fans; numerous shallow gullies.	Brown coarse sandy loam, slightly hard, massive, slightly acid, reddish-brown or red sandy clay loam, very hard, massive, medium acid; reddish-brown, coarse sandy loam, hard, massive, neutral.	Good	Slow	Rapid
MvA	Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes.	Drainageways in undulating old fans.	Brown coarse sandy loam, slightly hard, massive, slightly acid, mottled; reddish-brown or red sandy clay loam, massive, medium acid, mottled; reddish-brown coarse sandy loam, hard, massive, neutral, mottled.	Poor	Slow	Very slow
OaA	Oakdale sandy loam, 0 to 3 percent slopes.	Nearly level to very gently sloping alluvial fans and terraces.	Grayish-brown sandy loam, slightly hard, massive, neutral; brown, heavy sandy loam, hard, massive, neutral; brown sandy loam, soft, massive, neutral.	Good	Moderate	Very slow
PaA	Paulsell clay, 0 to 1 percent slopes.	Nearly level bed of former lake.	Dark-gray clay, hard, blocky (granular in upper few inches when dry), slightly acid; dark-gray or dark reddish-gray clay, hard, blocky, calcareous, mildly alkaline; pale-brown, stratified fine sandy loam and clay loam, massive.	Imperfect	Slow	Very slow
PcB	Pentz cobbly loam, very shallow, 0 to 8 percent slopes.	Undulating ridgetops.	Grayish-brown cobbly loam, hard, weak blocky, neutral; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Excessive	Moderate	Rapid

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	18 to 26 inches to dense sandy clay loam subsoil.	Low	3 to 4 (includes 1 inch in subsoil).	Dry-farmed grain, range, irrigated pasture, few grapes, orchards.	IIIs-3	Fairly well suited to grapes, poorly suited to orchards, well suited to other crops grown; soil is generally low in phosphate, nitrogen, sulfur, and possibly zinc; irrigation water should be applied carefully to avoid waterlogging.
Slight	18 to 26 inches to dense sandy clay loam subsoil.	Low	3 to 4 (includes 1 inch in subsoil).	Dry-farmed grain, range, irrigated pasture.	IVe-3	Well suited to crops grown; if cultivated crops are grown, they should be planted and irrigated on graded contours; nutrient deficiencies same as for Montpellier coarse sandy loam, 0 to 3 percent slopes.
Moderate	18 to 26 inches to dense sandy clay loam subsoil.	Low	3 to 4 (includes 1 inch in subsoil).	Dry-farmed grain, range.	IVe-3	Same as for Montpellier coarse sandy loam, 3 to 8 percent slopes, but soil not suited to more intensive crops because of erosion hazard; range improvement gives large increases in yields of forage.
Moderate	4 to 18 inches to sandy clay loam subsoil.	Low	2 to 3	Dry-farmed grain, range.	VIe-3	Well suited to improved range; suitable for grain only with intensive erosion control measures; in places the reddish subsoil is exposed.
High	0 to 12 inches to dense sandy clay loam subsoil.	Low	1 to 3	Dry-farmed grain, range.	VIe-9	Not suited to grain, well suited to improved range; in places the reddish subsoil is exposed.
High	0 to 12 inches to dense sandy clay loam subsoil.	Low	1 to 3	Range	VIe-9	Well suited to improved range, not suited to other crops; reddish subsoil is exposed in many places.
Slight	18 to 26 inches to dense sandy clay loam subsoil.	Low	3 to 4	Irrigated pasture	IIIw-3	Well suited to irrigated pasture; wetness can be reduced by the use of ditches or tile to intercept seepage and runoff from surrounding pastures.
Slight	More than 6 feet	High	7 to 10	Orchards, vineyards, alfalfa, field and truck crops.	I-1	Well suited to all crops grown.
Slight	More than 6 feet	Moderate	10 to 12	Rice and irrigated pasture; unirrigated range and small grain.	IIIw-5	Well suited to all crops grown; soil is difficult to work.
High	2 to 4 inches to rock	Very low	Less than ½	Range	VIIe-9	Range; carrying capacity very low; reseeding not feasible.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
PcD	Pentz cobbly loam, very shallow, 8 to 30 percent slopes.	Rolling and hilly	Grayish brown cobbly loam, hard, weak blocky, neutral; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Excessive	Moderate	Very rapid
PeB	Pentz gravelly loam, 3 to 8 percent slopes.	Undulating; mound microrelief.	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Good	Moderate	Slow to medium.
PeD	Pentz gravelly loam, 8 to 30 percent slopes.	Rolling and hilly	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Somewhat excessive.	Moderate	Medium to rapid.
PeF	Pentz gravelly loam, 30 to 75 percent slopes.	Steep hillsides that have bands of rock outcrops.	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Excessive	Moderate	Rapid to very rapid.
PfB	Pentz loam, 3 to 8 percent slopes.	Undulating; mound microrelief.	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Good	Moderate	Slow to medium.
PfD	Pentz loam, 8 to 30 percent slopes.	Rolling and hilly	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Somewhat excessive.	Moderate	Medium to rapid.
PfE	Pentz loam, 30 to 45 percent slopes.	Steep hillsides that have bands of rock outcrops.	Grayish-brown gravelly loam, hard, weak blocky, slightly acid; none; bluish-gray or brown, weakly consolidated andesitic mudstone.	Excessive	Moderate	Rapid to very rapid.
PmB	Pentz loam, moderately deep, 3 to 8 percent slopes.	Undulating areas and ridgetops.	Grayish-brown loam, hard, blocky, slightly acid; similar to surface soil except neutral; light brownish-gray to white, weakly consolidated siltstone or fine sandstone, neutral.	Good	Moderate	Slow to medium.
PmC	Pentz loam, moderately deep, 8 to 15 percent slopes.	Rolling hills; complex slopes.	Grayish-brown loam, hard, blocky, slightly acid; similar to surface soil except neutral; light brownish-gray to white, weakly consolidated siltstone or fine sandstone, neutral.	Good	Moderate	Medium
PmC2	Pentz loam, moderately deep, 8 to 15 percent slopes, eroded.	Rolling hills; complex slopes.	Grayish-brown loam, hard, blocky, slightly acid; similar to surface soil except neutral; light brownish-gray to white, weakly consolidated siltstone or fine sandstone, neutral.	Good	Moderate	Medium
PmD	Pentz loam, moderately deep, 15 to 30 percent slopes.	Hilly, complex slopes	Grayish-brown loam, hard, blocky, slightly acid; similar to surface soil but neutral; light brownish-gray to white, weakly consolidated siltstone or fine sandstone, neutral.	Good	Moderate	Medium to rapid.
PmD2	Pentz loam, moderately deep, 15 to 30 percent slopes, eroded.	Hilly, complex slopes	Grayish-brown loam, hard, blocky, slightly acid; similar to surface soil but neutral; light brownish-gray to white, weakly consolidated siltstone or fine sandstone, neutral.	Good	Moderate	Medium to rapid.
PoB	Pentz sandy loam, 3 to 8 percent slopes.	Undulating	Grayish-brown sandy loam, slightly hard, massive or weak granular, slightly acid; none; gray sandstone that contains mainly andesitic sands.	Good	Moderately rapid.	Slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Very high	2 to 4 inches to rock	Very low	Less than ½	Range	VIIe-9	Same as for preceding soil but carrying capacity is even lower; many areas are almost bare of soil.
Slight	8 to 14 inches to rock	Low	½ to 1½	Range	VIe-3	Well suited to range; forage is highly nutritious, but it dries up early in spring.
Moderate to high.	6 to 14 inches to rock	Very low	½ to 1	Range	VIe-3	Same as for Pentz gravelly loam, 3 to 8 percent slopes.
Very high	6 to 10 inches to rock	Very low	½ to 1	Range	VIIe-3	Same as for Pentz gravelly loam, 3 to 8 percent slopes, but yields are lower.
Slight	8 to 14 inches to rock	Low	1 to 2	Range	VIe-3	Well suited to range; forage is highly nutritious; dries up early in the spring but not quite so early as on the Pentz gravelly loam soils.
Moderate to high.	6 to 14 inches to rock	Very low	1 to 2	Range	VIe-3	Same as for Pentz loam, 3 to 8 percent slopes, but yields are slightly lower.
Very high	6 to 12 inches to rock	Very low	1 to 2	Range	VIIe-3	Same as for Pentz loam, 3 to 8 percent slopes, but yields are lower.
Slight	20 to 30 inches to soft rock.	Moderate	4 to 7	Dry-farmed grain and range.	IIIe-1	Well suited to grain and range and, if water becomes available, for vineyards and field crops.
Moderate	20 to 30 inches to soft rock.	Moderate	4 to 7	Dry-farmed grain and range.	IVe-1	Same as for Pentz loam, moderately deep, 3 to 8 percent slopes, but more care would be needed to control erosion if irrigated.
Moderate	14 to 25 inches to soft rock.	Moderate	3 to 6	Dry-farmed grain and range.	IVe-1	Fairly well suited to crops grown; vineyards and field crops could be grown if irrigation water becomes available, but intensive erosion control practices would be necessary.
High	20 to 30 inches to soft rock.	Moderate	4 to 7	Dry-farmed grain and range.	VIe-3	Best suited to range; forage is highly nutritious.
High	12 to 28 inches to soft rock.	Moderate	3 to 7	Dry-farmed grain and range.	VIe-3	Best suited to range; forage is highly nutritious.
Slight	14 to 24 inches to rock.	Low	2 to 3	Range	VIe-3	Well suited to improved range.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
PpB	Pentz-Redding gravelly loams, 0 to 8 percent slopes.	Undulating; braided drainageways and mound microrelief.	Complex generally consists of about 50 percent mounds and low ridges of Redding soil in a braided matrix of Pentz soil; for profile description of soils of this complex, see Pentz gravelly loam, 3 to 8 percent slopes, and Redding gravelly loam, 0 to 8 percent slopes.	Good	Moderate (Pentz), very slow (Redding).	Slow
PtB	Peters clay, 0 to 8 percent slopes.	Smooth or concave slopes.	Dark-gray clay, very hard, coarse blocky (granular surface mulch), slightly acid; none; bluish-gray to brown andesitic mudstone, sandstone, or conglomerate, moderately consolidated.	Good	Slow	Very slow to slow.
PtC	Peters clay, 8 to 15 percent slopes.	Smooth or concave slopes.	Dark-gray clay, very hard, coarse blocky (granular surface mulch), slightly acid; none; bluish-gray to brown andesitic mudstone, sandstone, or conglomerate, moderately consolidated.	Good	Slow	Slow to medium.
PvB	Peters cobbly clay, 0 to 8 percent slopes.	Smooth or concave slopes.	Dark-gray clay, very hard, coarse blocky (granular surface mulch), slightly acid; none; bluish-gray to brown andesitic mudstone, sandstone, or conglomerate, moderately consolidated.	Good	Slow	Very slow to slow.
PvC	Peters cobbly clay, 8 to 15 percent slopes.	Smooth or concave slopes.	Dark-gray clay, very hard, coarse blocky (granular surface mulch), slightly acid; none; bluish-gray to brown andesitic mudstone, sandstone, or conglomerate, moderately consolidated.	Good	Slow	Slow to medium.
PxB	Peters-Pentz complex, 0 to 8 percent slopes.	Undulating or gently sloping; mound microrelief in places.	Complex consists of intricate pattern of 60 percent Peters soils in concave or depressional areas and 40 percent Pentz soils on low ridges; for profile description of soils of this complex, see Peters clay, 0 to 8 percent slopes, and Pentz gravelly loam, 3 to 8 percent slopes.	Good	Slow (Peters), moderate (Pentz).	Very slow to medium.
PxC	Peters-Pentz complex, 8 to 15 percent slopes.	Rolling or sloping	Complex consists of intricate pattern of 60 percent Peters soils in concave or depressional areas and 40 percent Pentz soils on low ridges; for profile description of soils of this complex, see Peters clay, 0 to 8 percent slopes, and Pentz gravelly loam, 3 to 8 percent slopes.	Good	Slow (Peters), moderate (Pentz).	Slow to medium.
RaA	Raynor clay, 0 to 3 slopes.	Very gentle slopes; smooth or slightly concave.	Dark-gray clay, very hard, very coarse blocky (granular surface mulch), slightly acid; dark-gray clay, very hard, coarse blocky, neutral, slightly calcareous; light-gray to grayish-brown andesitic tuff mudstone.	Good	Slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	8 to 20 inches to rock or hardpan.	Low	1 to 3	Range	VIe–9	Well suited to range; forage is highly nutritious, but it dries up early in spring.
Slight	12 to 20 inches to rock.	Moderate	2 to 4	Range, irrigated pasture.	IIIs–5	Well suited to crops grown; forage is highly nutritious.
Slight	12 to 20 inches to rock.	Moderate	2 to 4	Range	IVe–5	Well suited to range; also to irrigated pasture if irrigated carefully.
Slight	12 to 20 inches to rock.	High	2 to 3	Range	IIIs–5	Suitable for range and, if cobbles are removed, for irrigated pasture; forage is highly nutritious.
Slight	12 to 20 inches to rock.	High	2 to 3	Range	IVe–5	Same as for Peters cobbly clay, 0 to 8 percent slopes.
Slight	12 to 20 inches to bedrock (Peters), 6 to 12 inches to bedrock (Pentz).	Moderate (Peters), low (Pentz).	1 to 4	Range	VIe–3	Well suited to range.
Slight (Peters), moderate (Pentz).	12 to 20 inches to bedrock (Peters), 6 to 12 inches to bedrock (Pentz).	Moderate (Peters), low (Pentz).	1 to 4	Range	VIe–3	Well suited to range.
Slight	24 to 48 inches to tuff rock.	High	6 to 12	Dry-farmed grain, irrigated pasture, range.	IIIs–5	Well suited to crops grown; soil is difficult to work; produces nutritious forage.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
RaB	Raynor clay, 3 to 8 percent slopes.	Gentle slopes; smooth or slightly concave.	Dark-gray clay, very hard, very coarse blocky (granular surface mulch), slightly acid; dark-gray clay, very hard, coarse blocky, neutral, slightly calcareous; light-gray to grayish-brown andesitic tuff mudstone.	Good	Slow	Slow
RaC	Raynor clay, 8 to 15 percent slopes.	Smooth or concave slopes.	Dark-gray clay, very hard, very coarse blocky (granular surface mulch), slightly acid; dark-gray clay, very hard, coarse blocky, neutral, slightly calcareous; light-gray to grayish-brown andesitic tuff mudstone.	Good	Slow	Slow to medium.
RbB	Raynor cobbly clay, 0 to 8 percent slopes.	Gentle slopes; smooth or slightly concave.	Dark-gray cobbly clay, very hard, very coarse blocky (granular surface mulch), slightly acid; dark-gray clay, very hard, coarse blocky, neutral, slightly calcareous; light-gray to grayish-brown andesitic tuff mudstone.	Good	Slow	Very slow to slow.
RbC	Raynor cobbly clay, 8 to 15 percent slopes.	Smooth or concave slopes.	Dark-gray cobbly clay, very hard, very coarse blocky (granular surface mulch), slightly acid; dark-gray clay, very hard, coarse blocky, neutral, slightly calcareous; light-gray to grayish-brown andesitic tuff mudstone.	Good	Slow	Slow to medium.
RcB	Redding cobbly loam, 0 to 8 percent slopes.	Gently sloping; mound microrelief.	Light-brown to reddish-brown cobbly loam, slightly hard, massive, medium acid; reddish-brown, gravelly clay, very hard, prismatic, strongly acid; reddish-brown, indurated iron-silica hardpan overlying reddish-brown, gravelly sandy loam, slightly acid, massive.	Good	Very slow	Very slow to slow.
RcC	Redding cobbly loam, 8 to 15 percent slopes.	Sloping terrace edges	Light-brown to reddish-brown cobbly loam, slightly hard, massive, medium acid; reddish-brown, gravelly clay, very hard, prismatic, strongly acid; reddish-brown, indurated iron-silica hardpan overlying reddish-brown, gravelly sandy loam, slightly acid, massive.	Good	Very slow	Slow to medium.
RdB	Redding gravelly loam, 0 to 8 percent slopes.	Gently sloping; mound microrelief.	Light-brown to reddish-brown cobbly loam, slightly hard, massive, medium acid; reddish-brown, gravelly clay, very hard, prismatic, strongly acid; reddish-brown, indurated iron-silica hardpan overlying reddish-brown, gravelly sandy loam, slightly acid, massive.	Good	Very slow	Slow to medium.
Rr	Riverwash	Bottom lands subject to frequent flooding.	Pale-brown sand or gravelly sand, loose, single grain, neutral; none; stratified sand and gravel.	Excessive	Very rapid	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	24 to 48 inches to tuff rock.	High	6 to 12	Dry-farmed grain, irrigated pasture, range.	IIIs-5	Same as for Raynor clay, 0 to 3 percent slopes, but irrigation water must be applied slowly or on the contour to control erosion.
Slight	24 to 48 inches to tuff rock.	High	6 to 12	Dry-farmed grain, irrigated pasture, range.	IVe-5	Same as for Raynor clay, 0 to 3 percent slopes, but irrigation water must be applied slowly on the contour to control erosion.
Slight	24 to 48 inches to tuff rock.	High	4 to 10	Range	IIIs-5	Well suited to range; also suited to dry-farmed grain and irrigated pasture; soil is difficult to work because of its texture and cobbles; produces nutritious forage; apply irrigation slowly on the contour to control erosion.
Slight	24 to 48 inches to tuff rock.	High	4 to 10	Range	IVe 5	Same as for Raynor cobbly clay loam, 0 to 8 percent slopes; apply irrigation slowly on the contour to control erosion.
Slight	10 to 16 inches to claypan overlying hardpan.	Low	1½ to 3	Range	VIe-9	Range; reseeding difficult because of cobbly surface; nutritive value of forage is poor.
Moderate	5 to 15 inches to claypan overlying hardpan.	Very low	1 to 2	Range	VIe-9	Same as for Redding cobbly loam, 0 to 8 percent slopes.
Slight	10 to 16 inches to claypan overlying hardpan.	Low	1½ to 3	Range, irrigated pasture.	IVe-3	Suitable for range and fairly well suited to irrigated pasture; nutritive value of forage is poor; range improvement is costly because of low fertility.
High (channeling).	Variable	Very low	0 to 1	Range	VIIIs-1	Little or no agricultural value except for a little grazing; some areas used for gravel or sand for construction.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
ReA	Rocklin sandy loam, 0 to 3 percent slopes.	Very gently undulating; mound microrelief where not cultivated.	Brown sandy loam, hard, massive, strongly acid; reddish-brown sandy clay loam, hard, weak blocky, neutral to mildly alkaline; thin, strongly cemented hardpan resting on pale-brown to white weakly consolidated sediments.	Good	Moderately slow.	Very slow to slow.
ReB	Rocklin sandy loam, 3 to 8 percent slopes.	Undulating; mound microrelief where not cultivated.	Brown sandy loam, hard, massive, strongly acid; reddish-brown sandy clay loam, hard, weak blocky, neutral to mildly alkaline; thin, strongly cemented hardpan resting on pale-brown to white weakly consolidated sediments.	Good	Moderately slow.	Slow
RfA	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level basins and valley floor.	Dark-gray clay, very hard, blocky, very strongly alkaline, calcareous; gray, heavy clay, blocky, very hard, very strongly alkaline, calcareous; light-gray, mottled clay, hard, blocky, strongly alkaline, calcareous.	Poor	Very slow	Very slow
RgA	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level basins and valley floor.	Dark-gray clay, very hard, blocky, very strongly alkaline, calcareous; gray, heavy clay, blocky, very hard, very strongly alkaline, calcareous; light-gray, mottled clay, hard, blocky, strongly alkaline, calcareous.	Poor	Very slow	Very slow
RkA	Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level basins and valley floor.	Dark-gray clay, very hard, blocky, very strongly alkaline, calcareous; gray, heavy clay, blocky, very hard, very strongly alkaline, calcareous; light-gray, mottled clay, hard, blocky, strongly alkaline, calcareous.	Poor	Very slow	Very slow
RnA	Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level basins that have mound microrelief.	This complex of soils consists of 40 percent of Waukena soil on mounds in flat basins of Rossi soil; for profile description of soils of this complex, see Rossi clay, moderately saline-alkali, 0 to 1 percent slopes, and Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Poor	Very slow	Very slow
RoA	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level basins that have mound microrelief.	This complex of soils consists of 40 percent of Waukena soil on mounds in flat basins of Rossi soil; for profile description of soils of this complex see Rossi clay, strongly saline-alkali, 0 to 1 percent slopes, and Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Poor	Very slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	18 to 30 inches to hardpan.	Low	2 to 4	Dry-farmed grain, range, irrigated pasture.	IIIs-3	Well suited to crops grown; soil is low in nitrogen, phosphate, sulfur, and probably zinc; irrigated crops respond vigorously to combination of nitrogen and phosphate; soil has a moderate tendency to become compact if worked when too moist; fertilizer should be used sparingly on dry-farmed grain to avoid excessive early growth in dry years.
Slight	18 to 30 inches to hardpan.	Low	2 to 4	Dry-farmed grain, range, irrigated pasture.	IVe-3	Same as for Rocklin sandy loam, 0 to 3 percent slopes, but cross-slope or contour cultivation and sprinkler or graded-furrow irrigation needed to control erosion.
None	12 to 48 inches to water table.	Low	2 to 4	Range, irrigated pasture.	VIw-6	Range, irrigated pasture; produces fair saltgrass; fairly well suited to trefoil pasture if soil can be kept moist; salt and alkali reclamation is slow.
None	12 to 48 inches to water table.	Low	1 to 2	Range	VIw-6	Range; produces poor saltgrass; poorly suited to irrigated pasture; salt and alkali reclamation is very slow.
None	12 to 48 inches to water table.	Low	2 to 4	Range, irrigated pasture.	IVw-6	Range, irrigated pasture; produces fair saltgrass, fairly well suited to trefoil pasture if soil can be kept moist; salt and alkali reclamation is slow.
None	12 to 48 inches to water table.	Low	1 to 4	Range, with some irrigation done without land preparation (called wild flooding).	IVs-8	Range; produces fair yield of saltgrass; poorly suited to irrigated pasture; salt and alkali reclamation is slow.
None	12 to 48 inches to water table.	Low	1 to 2	Range, with some irrigation done without land preparation (called wild flooding).	VIw-6	Same as for Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes, but this soil produces low yields of saltgrass; salt and alkali reclamation is very slow.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
RtA	Ryer clay, 0 to 1 percent slopes.	Nearly level terraces	Brown to reddish-brown clay, very hard, granular, slightly acid; reddish-brown clay, hard, prismatic, slightly acid, in places, slightly calcareous in lower part; light-brown loam, hard, blocky, neutral.	Good	Slow	Very slow
RvA	Ryer clay loam, 0 to 1 percent slopes.	Nearly level terraces	Brown or reddish-brown clay loam, hard, weak granular, slightly acid; reddish-brown heavy silty clay loam or silty clay, hard, prismatic, slightly acid, in places, slightly calcareous in lower part; light-brown loam, hard, blocky, neutral.	Good	Slow	Very slow
RyA	Ryer loam, 0 to 1 percent slopes.	Nearly level terraces	Brown or reddish-brown clay loam, hard, weak granular, slightly acid; reddish-brown heavy silty clay loam or silty clay, hard, prismatic, slightly acid, and in places slightly calcareous in lower part; light-brown loam, hard, blocky, neutral.	Good	Slow	Very slow
SaA	San Joaquin sandy loams, 0 to 3 percent slopes.	Very gently undulating, mound microrelief where not leveled.	Brown to reddish-brown sandy loams, slightly hard, weak granular to massive, medium acid; reddish-brown to red sandy clay, very hard, prismatic, slightly acid to neutral; indurated, reddish-brown hardpan overlying light yellowish-brown sandy loam, hard, mildly alkaline.	Good	Very slow	Very slow to slow.
SaB	San Joaquin sandy loams, 3 to 8 percent slopes.	Undulating old alluvial fans.	Brown to reddish-brown sandy loams, slightly hard, weak granular to massive, medium acid; reddish-brown to red sandy clay, very hard, prismatic, slightly acid to neutral; indurated, reddish-brown hardpan overlying light yellowish-brown sandy loam, hard, mildly alkaline.	Good	Very slow	Slow to medium.
SmA	San Joaquin and Madera soils, 0 to 3 percent slopes.	Gently undulating old alluvial fans.	In some areas, the soils of this unit occur in close association and, because of their similar characteristics and management requirements, were not separated; for profile description of the soils of this undifferentiated unit, see San Joaquin sandy loams, 0 to 3 percent slopes, and Madera sandy loam, 0 to 2 percent slopes.	Good	Very slow	Very slow to slow.
Sc	Schist rockland	Areas of tombstone-like rock outcrops.	Areas of rock slabs standing nearly upright; a little soil between the rocks.			
SnA	Snelling sandy loam, 0 to 3 percent slopes.	Smooth, nearly level alluvial terraces.	Brown sandy loam, hard, weak granular or massive, slightly acid; brown sandy clay loam, hard, weak blocky to massive, medium acid; brown, coarse sandy loam, slightly hard, massive, slightly acid to neutral.	Good	Moderately slow.	Slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	More than 6 feet	Moderate to low.	10 to 12	Irrigated pasture, dry-farmed grain, range.	IIIs–5	Suited to crops grown; other crops can probably be grown successfully if soil is irrigated carefully and fertilized with nitrogen and phosphate; soil has strong tendency to become compact if worked when too moist.
Slight	More than 6 feet	Moderate to low.	10 to 12	Irrigated pasture, dry-farmed grain, range, and some orchard, vineyard, and truck crops.	IIs–7	Suited to crops grown; irrigation water must be applied slowly; soil has strong tendency to become compact if worked when too moist; cultivation should be timed carefully and kept to a minimum; marked response to nitrogen and phosphate together.
Slight	More than 6 feet	Moderate to low.	10 to 12	Irrigated pasture, dry-farmed grain, range, and some orchard, vineyard, and truck crops.	IIs–7	Same as for Ryer clay loam, 0 to 1 percent slopes.
Slight	14 to 20 inches to claypan, and 16 to 30 inches to hardpan.	Low	2 to 4	Irrigated pasture and field crops, dry-farmed grain.	IVs–3	Well suited to pasture and dry-farmed grain; for other crops, very careful irrigation needed to avoid waterlogging; surface drains should be provided in places; soil deficient in nitrogen and phosphate.
Slight	12 to 18 inches to claypan, and 14 to 24 inches to hardpan.	Low	2 to 4	Irrigated pasture and field crops, dry-farmed grain.	IVe–3	Same as for San Joaquin sandy loams, 0 to 3 percent slopes, but irrigation by sprinklers or contour furrows needed to control erosion.
Slight	16 to 30 inches to hardpan.	Low	2 to 4	Irrigated pasture and field crops, dry-farmed grain.	IVs–3	Same as for San Joaquin sandy loam, 0 to 3 percent slopes.
				Included in range	VIIIs–1	Included areas support a little grass, much of which is inaccessible to livestock.
Slight	More than 6 feet	Moderate	7 to 9	Grapes, orchards, field and truck crops, alfalfa, irrigated pasture.	IIs–7	Well suited to a wide variety of crops; legumes respond to sulfur; irrigation water should be applied with care.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
SnB	Snelling sandy loam, 3 to 8 percent slopes.	Sloping terrace edges.	Brown sandy loam, hard, weak granular or massive, slightly acid; brown sandy clay loam, hard, weak blocky to massive, medium acid; brown coarse sandy loam, slightly hard, massive, slightly acid to neutral.	Good	Moderately slow.	Slow to medium.
SwA	Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes.	Depressions in nearly level alluvial terraces.	Brown sandy loam, hard, weak granular or massive, slightly acid; brown sandy clay loam, mottled, hard, weak blocky to massive, medium acid; brown coarse sandy loam, mottled, slightly hard, massive, slightly acid to neutral.	Poor	Moderately slow.	Ponded
TbA	Temple loam, overwashed, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Brown loam, mottled, slightly hard, massive, neutral; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Imperfect	Slow	Very slow
TcA	Temple loam, overwashed, slightly saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Brown loam, mottled, slightly hard, massive, neutral; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Imperfect	Slow	Very slow
TdA and CnA.	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Brown loam, mottled, slightly hard, massive, neutral; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Poor	Slow	Very slow
TeA	Temple silty clay, slightly saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Gray to dark-gray silty clay, very hard, weak blocky, mildly alkaline; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Imperfect	Slow	Very slow
TfA	Temple silty clay, moderately saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Gray to dark-gray silty clay, very hard, weak blocky, mildly alkaline; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Poor	Slow	Very slow
TgA	Temple silty clay loam, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Gray to dark-gray silty clay, very hard, weak blocky, mildly alkaline; gray silty clay loam; hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Imperfect	Slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight to moderate.	More than 6 feet	Moderate	7 to 9	Grapes, orchards, field and truck crops, alfalfa, irrigated pasture.	IIe-1	Same as for Snelling sandy loam, 0 to 3 percent slopes, but irrigation should be by contour furrows or sprinklers.
None	More than 6 feet	Moderate	7 to 9	Irrigated pasture	IIIw-3	Irrigated pasture unless drained; if drainage is improved, soil would be suitable for the same crops as Snelling sandy loam, 0 to 3 percent slopes.
None	3 to 5 feet to water table.	High	8 to 15	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIw-2	Suitable for crops grown; not suitable for orchards or vineyards because of high water table and occasional flooding; soil is easy to till.
None	3 to 5 feet to water table.	Moderate	8 to 15	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIw-2	Same as for Temple loam, overwashed, 0 to 1 percent slopes, but reclamation not likely to be permanent because water table fluctuates.
None	2 to 4 feet to water table.	Moderate	8 to 12	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIIw-6	Suitable for irrigated pasture and barley; poorly suited to other field crops; not suited to orchards or vineyards; salt reclamation not likely to be permanent because water table fluctuates.
None	3 to 5 feet to water table.	Moderate	8 to 15	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIIw-5	Same as for Temple loam, overwashed, moderately saline, 0 to 1 percent slopes, but this soil is difficult to till.
None	2 to 4 feet to water table.	Low	8 to 12	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIIw-5	Same as for Temple loam, overwashed, moderately saline, 0 to 1 percent slopes, but this soil is difficult to till.
None	3 to 5 feet to water table.	High	8 to 15	Irrigated pasture, alfalfa, range; field crops in years without flooding.	IIw-2	Suitable for crops grown; not suitable for orchards or vineyards because of high water table and occasional flooding.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
ThA	Temple silty clay loam, slightly saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Gray to dark-gray silty clay loam, very hard, weak blocky, mildly alkaline; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Imperfect	Slow	Very slow
TkA	Temple silty clay loam, moderately saline, 0 to 1 percent slopes.	Nearly level alluvial flood plains subject to fluctuating water table and occasional flooding.	Gray to dark-gray silty clay loam, very hard, weak blocky, mildly alkaline; gray silty clay loam, hard, blocky, moderately alkaline, calcareous; grayish-brown, mottled sandy loam or very fine sandy loam, soft, moderately alkaline, calcareous.	Poor	Slow	Very slow
Tx	Terrace escarpments.	Usually steep; some sloping escarpments of weakly consolidated materials.	Outcroppings of soft and weakly consolidated sandy or silty sediments.	Excessive	Moderate to rapid.	Rapid to very rapid.
HaB	Toomes rocky loam, 0 to 8 percent slopes.	Small bodies of soil among areas of lava rock land.	Brown rocky loam, slightly hard, weak granular, medium acid; none; dense, hard latite lava.	Good	Moderate	Very slow to slow.
TmA	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray fine sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray fine sandy loam, massive, hard, strongly alkaline, strongly calcareous; light yellowish-brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Moderately slow.	Very slow
TnA	Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray fine sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray fine sandy loam, massive, hard, strongly alkaline, strongly calcareous; light yellowish-brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Slow	Very slow
ToA	Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray fine sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray fine sandy loam, massive, hard, strongly alkaline, strongly calcareous; light yellowish-brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Slow	Very slow
TpA	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray sandy loam, massive, hard, strongly alkali, strongly calcareous; light yellowish-brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Moderate	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
None	3 to 5 feet to water table.	Moderate	8 to 15	Irrigated pasture, alfalfa, range; also field crops in years without flooding.	IIw-2	Same as for Temple silty clay loam, 0 to 1 percent slopes; reclamation possible but not likely to be permanent because water table fluctuates.
None	2 to 4 feet	Low	8 to 12	Irrigated pasture, range.	IIIw-6	Suitable for irrigated pasture and range; poorly suited to cultivated crops; reclamation difficult and not likely to be permanent.
High (gully)	Variable, usually shallow or very very shallow.	Very low	Variable, usually low to very low.	Range	VIIIs-1	Unsuitable for grazing because of high hazard of gully erosion.
Slight	4 to 12 inches to hard rock.	Low	1 to 2	Range	VIIe-9	Range; too shallow and rocky to warrant range improvement.
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	2 to 5	Irrigated pasture, range.	IIs-6	Suitable for trefoil pasture and saltgrass range; reclamation fairly easy if good drainage can be provided and gypsum added; suitable for a number of field crops if reclaimed.
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	2 to 5	Irrigated pasture, range.	IIIs-6	Same as for Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes, but yields lower and reclamation more difficult.
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	1 to 4	Range	IVs-6	Suitable only for range unless reclaimed; yields low; reclamation difficult because large quantities of water and gypsum, as well as adequate drainage, are required.
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	1 to 4	Irrigated pasture, range, field crops.	IIs-6	Suitable for trefoil pasture and saltgrass range; growth of field crops spotty; reclamation easy if good drainage can be provided and gypsum added; suitable for a wide variety of crops if reclaimed.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
TrA	Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray sandy loam, massive, hard, strongly alkaline, strongly calcareous; light yellowish brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Moderately slow.	Very slow.
TsA	Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level plains that have mound microrelief in places.	Light brownish-gray sandy loam, slightly hard, massive, strongly alkaline, calcareous; light brownish-gray sandy loam, massive, hard, strongly alkaline, strongly calcareous; light yellowish-brown sandy loam, mottled, massive, soft, moderately calcareous, moderately alkaline.	Moderately good.	Slow.	Very slow.
Tt	Tuff rockland	Bare tuff rock on escarpments.	Bare rock and steep, rocky escarpments.			
TuA	Tujunga loamy sand, 0 to 3 percent slopes.	Nearly level bottom lands and alluvial fans cut by shallow channels in places.	Pale-brown or light brownish-gray loamy sand, loose, single grain, neutral to mildly alkaline; similar to surface soil but stratified with fine sand; similar to surface soil but stratified with sand and fine sandy loam in places.	Somewhat excessive.	Very rapid	Very slow.
TuB	Tujunga loamy sand, 3 to 5 percent slopes.	Sloping terrace breaks.	Pale-brown or light brownish-gray loamy sand, loose, single grain, neutral to mildly alkaline; similar to surface soil but stratified with fine sand; similar to surface soil but stratified with sand and fine sandy loam in places.	Somewhat excessive.	Very rapid	Very slow to slow.
TvA	Tujunga sand, 0 to 3 percent slopes.	Nearly level bottom lands and alluvial fans, shallow channels in places.	Pale-brown or light brownish-gray sand, loose, single grain, neutral to mildly alkaline; similar to surface soil but stratified with loamy sand; similar to subsoil.	Excessive	Very rapid	Very slow
WaA	Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level basin areas that have mound microrelief.	Gray fine sandy loam, slightly hard, weak platy, medium acid; grayish-brown sandy clay loam, very hard, columnar, mottled, calcareous, strongly alkaline; light-gray, mottled fine sandy loam, very hard, massive, calcareous, strongly alkaline.	Imperfect	Very slow	Very slow
WbA	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level basin areas that have mound microrelief.	Gray fine sandy loam, slightly hard, weak platy, medium acid; grayish-brown sandy clay loam, very hard, columnar, mottled, calcareous, strongly alkaline; light-gray, mottled fine sandy loam, very hard, massive, calcareous, strongly alkaline.	Imperfect	Very slow	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	1 to 4	Irrigated pasture, range.	IIIs-6	Same as for Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes, but yields are lower and reclamation is more difficult.
Slight	Variable depth (1 to 3 feet) to alkaline layer.	Low	1 to 3	Range	IVs-6	Suitable only for range unless reclaimed; yields low; reclamation difficult because large quantities of water and gypsum, as well as adequate drainage, are required.
					VIIIs-1	No agricultural use.
Slight channeling on bottom land; moderate wind erosion on fans.	More than 6 feet	Low	3 to 5	Range on bottom land; orchards, grapes, alfalfa, and field and truck crops on fans.	IIIe-4	Fairly well suited to alfalfa, grapes, sweetpotatoes, and strawberries; poorly suited to orchard and field crops; soil is low in nitrogen, zinc, and possibly other nutrients; frequent, light applications of water and split applications of fertilizer necessary for best yields; nematodes a problem on young peach trees and other sensitive crops.
Slight water erosion; moderate wind erosion.	More than 6 feet	Low	3 to 5	Orchards, grapes, alfalfa.	IIIe-4	Fairly well suited to grapes and alfalfa; poorly suited to orchard, truck, and field crops; sprinkler irrigation and contour planting and cultivation advisable; otherwise same as for Tujunga loamy sand, 0 to 3 percent slopes.
High (wind erosion).	More than 6 feet	Very low	1 to 3	Range on bottom land; orchards, grapes, field crops, alfalfa.	IVe-4	Poorly suited to crops grown; soil very low in nitrogen, zinc, and possibly other nutrients; requires even more frequent irrigation and fertilization than Tujunga loamy sand, 0 to 3 percent slopes.
Slight	2 to 6 inches to strongly alkaline claypan.	Very low	Less than 1	Range, irrigated pasture.	IIIs-8	Well suited to trefoil pasture and saltgrass range; water table generally within 4 feet of the surface; reclamation is slow because gypsum and large quantities of water are necessary; soil suitable for shallow-rooted crops only after reclamation.
Slight	2 to 6 inches to strongly alkaline claypan.	Very low	Less than 1	Range, irrigated pasture.	IVs-8	Same as for Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes, but yields are lower and reclamation more difficult.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
WcA	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	Nearly level basin areas that have mound microrelief.	Gray fine sandy loam, slightly hard, weak platy, medium acid; grayish-brown sandy clay loam, very hard, columnar, mottled, calcareous, strongly alkaline; light-gray, mottled fine sandy loam, very hard, massive, calcareous, strongly alkaline.	Imperfect	Very slow	Very slow
WdA	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	Nearly level basin areas that have mound microrelief.	Gray sandy loam, slightly hard, weak platy, medium acid; grayish-brown sandy clay loam, very hard, columnar, mottled, calcareous, strongly alkaline; light-gray, mottled fine sandy loam, very hard, massive, calcareous, strongly alkaline.	Imperfect	Very slow	Very slow
WeA	Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	Nearly level basin areas that have mound microrelief.	Gray sandy loam, slightly hard, weak platy, medium acid; grayish-brown sandy clay loam, very hard, columnar, mottled, calcareous, strongly alkaline; light-gray, mottled fine sandy loam, very hard, massive, calcareous, strongly alkaline.	Imperfect	Very slow	Very slow
WhD	Whiterock rocky silt loam, 8 to 30 percent slopes.	Rolling and hilly; numerous outcrops.	Light brownish-gray rocky silt loam, slightly hard, massive, slightly acid; none; hard slate that has nearly vertical cleavage.	Somewhat excessive.	Moderate	Medium to rapid.
WhF	Whiterock rocky silt loam, 30 to 60 percent slopes.	Steep; frequent rock outcrops.	Light brownish-gray rocky silt loam, slightly hard, massive, slightly acid; none; hard slate that has nearly vertical cleavage.	Excessive	Moderate	Very rapid
WkB	Whiterock silt loam, 0 to 8 percent slopes.	Undulating; only occasional rock outcrops.	Light brownish-gray rocky silt loam, slightly hard, massive, slightly acid; none; hard slate that has nearly vertical cleavage.	Good	Moderate	Very slow to medium.
WmB	Whitney sandy loams, 3 to 8 percent slopes.	Ridgetops and undulating areas.	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Good	Moderate	Slow
WmC	Whitney sandy loams, 8 to 15 percent slopes.	Rolling; complex slopes.	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Good	Moderate	Slow to medium.
WmC2	Whitney sandy loams, 8 to 15 percent slopes, eroded.	Rolling; complex slopes.	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Good	Moderate	Medium
WmD	Whitney sandy loams, 15 to 30 percent slopes.	Hilly; complex slopes.	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Good	Moderate	Medium

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
Slight	2 to 6 inches to strongly alkaline claypan.	Very low	Less than 1	Range	VIs-8	Suitable only for range; reclamation not feasible.
Slight	2 to 6 inches to strongly alkaline claypan.	Very low	Less than 1	Range, irrigated pasture.	IIIs-8	Same as for Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes, but a little easier to reclaim.
Slight	2 to 6 inches to strongly alkaline claypan.	Very low	Less than 1	Range, irrigated pasture.	IVs-8	Same as for Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes, but a little easier to reclaim.
Moderate to high.	4 to 8 inches to slate rock.	Very low	1 to 2	Range	VIIe-3	Range; forage yields are fair; range improvement generally not feasible; grazing needs to be carefully controlled because of increased erosion hazard.
Very high	4 to 8 inches to slate rock.	Very low	1 to 2	Range	VIIe-3	Range; forage yields are low; range improvement not feasible; grazing must be carefully controlled.
Slight	6 to 10 inches to slate rock.	Very low	1 to 2	Range	VIIe-3	Range; forage yields are fair; range improvement generally not feasible.
Slight	20 to 40 inches to weakly consolidated sediments.	Moderate	2 to 5	Dry-farmed grain, range.	IIIe-1	Well suited to crops grown; grapes and field crops can be grown if water becomes available and sprinkler irrigation and contour farming are used.
Moderate	12 to 40 inches to weakly consolidated sediments.	Moderate to low.	1 to 5	Dry-farmed grain, range.	IVe-1	Suited to range and to grain if erosion control practices are used; otherwise, same as for Whitney sandy loams, 3 to 8 percent slopes.
Moderate	6 to 30 inches to weakly consolidated sediments.	Moderate to low.	1 to 4	Dry-farmed grain, range.	IVe-1	Suited to range and to grain in rotation with improved range; slopes generally too complex for contour cultivation.
Moderate	12 to 30 inches to weakly consolidated sediments.	Moderate to low.	1 to 4	Dry-farmed grain, range.	VIe-4	Suited to improved range or sprinkler-irrigated pasture if water is available.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
WmD2	Whitney sandy loams, 15 to 30 percent slopes, eroded.	Hilly; complex slopes.	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Good	Moderate	Medium to rapid.
WmE2	Whitney sandy loams, 30 to 45 percent slopes, eroded.	Small, steep hillsides	Brown sandy loams, slightly hard, granular to massive, slightly acid; brown loam, blocky, slightly hard, slightly acid; pale-yellow, weakly consolidated granitic sediments, neutral.	Somewhat excessive.	Moderate	Rapid
WrA	Whitney and Rocklin sandy loams, 0 to 3 percent slopes.	Gently undulating	This undifferentiated unit consists of about 30 percent Rocklin, 45 percent Whitney, and 25 percent other soils, such as those of the Montpellier and Snelling series; for profile description of Whitney and Rocklin soils, see Whitney sandy loams, 3 to 8 percent slopes, and Rocklin sandy loam, 0 to 3 percent slopes.	Good	Moderate (Whitney) moderately slow (Rocklin).	Very slow to slow.
WrB	Whitney and Rocklin sandy loams, 3 to 8 percent slopes.	Undulating	This undifferentiated unit consists of about 30 percent Rocklin, 55 percent Whitney, and 15 percent other soils, such as those of the Montpellier and Snelling series; for profile description of Whitney and Rocklin soils, see Whitney sandy loams, 3 to 8 percent slopes, and Rocklin sandy loam, 0 to 3 percent slopes.	Good	Moderate (Whitney) moderately slow (Rocklin).	Slow
WrC	Whitney and Rocklin sandy loams, 8 to 15 percent slopes.	Rolling; complex slopes.	This undifferentiated unit consists of about 60 percent Whitney, 25 percent Rocklin, and 15 percent other soils, such as those of the Montpellier and Snelling series; for profile description of Whitney and Rocklin soils, see Whitney sandy loams, 3 to 8 percent slopes, and Rocklin sandy loam, 0 to 3 percent slopes.	Good	Moderate (Whitney) moderately slow (Rocklin).	Slow to medium.
WtA	Wyman clay loam, 0 to 1 percent slopes	Nearly level alluvial fans.	Brown clay loam, hard, massive, neutral; dark-brown to brown clay loam, blocky, hard, neutral; brown fine sandy loam, slightly hard, massive, neutral.	Good	Moderately slow.	Very slow
WvA	Wyman loam, 0 to 1 percent slopes.	Nearly level alluvial terraces.	Brown loam, slightly hard, massive, neutral; dark-brown to brown sandy clay loam, blocky, hard, neutral; brown fine sandy loam, slightly hard, massive, neutral.	Good	Moderately slow	Very slow
WyA	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes.	Nearly level alluvial fans.	Brown loam, slightly hard, massive, neutral; brown sandy clay loam, hard, blocky, neutral; gravelly sandy loam, massive, neutral.	Good	Moderately slow.	Very slow

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
			Inches			
High	6 to 24 inches to weakly consolidated sediments.	Moderate to low.	1 to 3	Dry-farmed grain, range.	VIe-4	Same as for Whitney sandy loams, 15 to 30 percent slopes.
Very high	6 to 18 inches to weakly consolidated sediments.	Low	1 to 2	Dry-farmed grain, range.	VIIe-3	Suitable for range.
Slight	18 to 45 inches to hardpan or weakly consolidated sediments.	Moderate to low.	2 to 6	Dry-farmed grain, irrigated pasture.	IIIe-1	Well suited to crops grown and to shallow-rooted field crops if irrigation, preferably with sprinklers, is carefully controlled.
Slight	14 to 40 inches to hardpan or weakly consolidated sediments.	Moderate to low.	2 to 5	Dry-farmed grain, irrigated pasture.	IIIe-1	Same as for Whitney and Rocklin sandy loams, 0 to 3 percent slopes, but where the soil is irrigated, contour cultivation is needed to control erosion.
Moderate	14 to 40 inches to hardpan or weakly consolidated sediments.	Moderate to low.	2 to 5	Dry-farmed grain, irrigated pasture.	IVe-1	Well suited to crops grown; soil should be left bare as little time as possible; slopes are generally too complex for contour cultivation.
Slight	More than 6 feet	High	10 to 14	Wide variety of intensive crops, including orchard crops.	I-1	Soil well suited to all crops grown; should be irrigated slowly; has a strong tendency to become compact if worked when too moist.
Slight	More than 6 feet	High	10 to 14	Wide variety of intensive crops, including orchard crops.	I-1	Same as for Wyman clay loam, 0 to 1 percent slopes, but this soil has only a moderate tendency to become compact if worked when too moist.
Slight	30 to 40 inches to gravel.	Moderate	6 to 8	Range	IIIs-3	Suitable for irrigated pasture and other crops if water is available.

TABLE 2.—*Descriptions of the soils of*

Map symbol	Soil name	Position and slope	Soil profile (surface soil; subsoil; substratum or parent material; all colors for dry soil)	Drainage	Permeability	Runoff
YkA	Yokohl loam, 0 to 1 percent slopes.	Nearly level; mound microrelief where uncultivated.	Brown loam, slightly hard, massive, slightly acid; reddish-brown silty clay, very hard, prismatic, slightly acid to neutral; strongly cemented hardpan overlying very pale brown silt loam, platy, hard, mildly alkaline.	Good	Very slow	Very slow
YoA	Yokohl clay loam, 0 to 3 percent slopes.	Nearly level; mound microrelief where uncultivated.	Brown clay loam, hard, blocky, slightly acid; reddish-brown silty clay, very hard, prismatic, slightly acid to neutral; strongly cemented hardpan overlying very pale brown silt loam, platy, hard, mildly alkaline.	Good	Very slow	Very slow to slow.
ZaB	Zaca clay, 3 to 8 percent slopes.	Undulating foothills	Dark-gray clay, hard, granular, moderately calcareous; dark-gray clay, hard, blocky, strongly calcareous; very strongly calcareous shale or mudstone; weakly consolidated.	Good	Moderately slow.	Slow
ZaC	Zaca clay, 8 to 15 percent slopes.	Sloping foothills; short slopes.	Dark-gray clay, hard, granular, moderately calcareous; dark-gray clay, hard, blocky, strongly calcareous; very strongly calcareous shale or mudstone; weakly consolidated.	Good	Moderately slow.	Slow to medium.
ZaD	Zaca clay, 15 to 30 percent slopes.	Hilly foothills	Dark-gray clay, hard, granular, moderately calcareous; dark-gray clay, hard, blocky, strongly calcareous; very strongly calcareous shale or mudstone; weakly consolidated.	Good	Moderately slow.	Medium

nursery stock, and pasture. Virtually all of the better soils are intensively farmed, and most of the level land is irrigated.

Acreages (*13*) of irrigated crops in the surveyed area in 1956 follow:

Crops	*Acres*
Pasture	91,306
Alfalfa	45,073
Deciduous fruits and nuts	42,757
Small grain	29,755
Field crops	19,218
Grapes	16,575
Berries	2,987
Rice	1,581
Tomatoes	1,253

Some of the important irrigated and dry-farmed crops grown in the county and their general management are discussed briefly as follows.

Alfalfa.—According to the Federal census, 280,160 tons of alfalfa were produced in Stanislaus County in 1959. Alfalfa is grown on a number of soils, including all of the soils of the alluvial flood plains and young alluvial fans and the deep soils of the older alluvial fans and terraces (fig. 9). Saline-alkali basin soils and shallow hardpan soils are not generally used for this crop. Yields average 6.4 tons per acre for the county as a whole, but yields of 8 to 10 tons are common on deep, well-drained soils, such as Hanford sandy loam.

***Figure 9.*—Alfalfa is one of the principal crops in the county.**

Soil management practices needed to produce high yields of alfalfa are irrigation, drainage, fertilization, and control of soil compaction. The total amount of irriga-

Eastern Stanislaus Area—Continued

Erosion hazard	Depth of root zone and kind of limiting layer	Fertility	Available water-holding capacity in root zone	Present use	Capability unit	Suitable use
Slight	12 to 24 inches to claypan and 24 to 38 inches to hardpan.	Low	4 to 7	Dry-farmed grain, irrigated pasture, range.	IVs–3	Soil well suited to irrigated pasture and improved range; fairly well suited to dry-farmed grain; tends to puddle and become compact if worked or trampled by livestock when wet; crops respond to combination of nitrogen and phosphate fertilizer.
Slight	12 to 24 inches to claypan and 24 to 38 inches to hardpan.	Low	5 to 8	Dry-farmed grain, irrigated pasture, range.	IVs–3	Same as for Yokohl loam, 0 to 1 percent slopes, but this soil has a strong tendency to become compact.
Slight	15 to 30 inches to calcareous shale.	Moderate	4 to 8	Range	IIIs -5	Suitable for dry-farmed grain and range; range is rich in clover and produces nutritious forage; little likelihood that irrigation water will become available.
Slight	12 to 20 inches to calcareous sediments.	Moderate	4 to 7	Range	IVe–5	Same as for Zaca clay, 3 to 8 percent slopes.
Moderate	10 to 15 inches to calcareous shale.	Moderate	3 to 5	Range	IVe–5	Suitable for grain only if farmed on the contour and the soil is left bare as little time as possible; otherwise, same as for Zaca clay, 3 to 8 percent slopes.

tion water applied on medium-textured soils should be limited to about 40 inches; no more than 5 inches should be used for each irrigation. Frequent, light applications of 3 to 4 inches are needed on coarse-textured Delhi, Hilmar, and Tujunga soils. Drainage should be used to keep standing water off the lower parts of the field and to control high water tables. Soil compaction can be avoided if the soil is leveled and the seedbed is prepared when the soil is no more than very slightly moist. Soils affected by salts and alkali should be reclaimed before planting alfalfa. (See "Saline and Saline-Alkali Soils" in this section.)

Almonds.—According to the census report, 6,058 tons of almonds were produced in Stanislaus County in 1959. Almonds are grown mainly on deep, medium- and coarse-textured, well-drained soils of the young alluvial fans; they are grown to some extent on the older terrace soils (fig. 10). The average yield for the county is about 1,000 pounds per acre but is about 1,500 pounds per acre on the Hanford soils. With good management, still higher yields are possible. One farmer obtained an average yield of 4,000 pounds per acre annually over a 4-year period by careful irrigation, prevention of zinc deficiency, control of insect pests, fertilization with 150 pounds of nitrogen per acre, adequate pruning, complete frost protection by orchard heaters, and use of enough bees for pollination. Some almonds are grown without irrigation, but yields are generally well below the county average.

***Figure 10.*—Almonds on Hanford sandy loam, deep over silt, 0 to 1 percent slopes**

Barley.—According to the Federal census, 34,042 acres of barley were harvested in 1959. About a third of this acreage was irrigated. Most of the crop is dry farmed, and the soil is summer-fallowed in alternate years; consequently, a much larger acreage is actually used for this crop than is harvested. The average yield for the county is 1,500 pounds per acre. The annual yield, however, ranges from 1,000 to 2,000 pounds, depending on the weather conditions. Dry farmed barley is grown mainly on soils that occur on the older terraces and fans and that have strongly developed profiles or rolling relief. Grain is grown most extensively on the Whitney, Rocklin, and Montpellier soils, but small acreages are grown on a large number of other soils (fig. 11).

Figure 11.—**Dry-farmed barley is the dominant crop on the Whitney, Rocklin, and Montpellier soils east of Montpelier.**

Stubble is generally turned under in the fall or spring, and the soils are cultivated throughout the summer to control weeds, conserve moisture, and encourage nitrate formation. Barley is planted after the first rains in the fall and harvested the following summer. Little fertilizer is generally used, but yields are often increased by adding fertilizer. On the deeper or finer textured soils, ammonium sulfate is spread by airplane in the spring of years with above-normal rainfall.

Blackeye beans.—Irrigated blackeye beans are often double cropped with small grain and rotated with alfalfa. A common rotation includes 2 years of beans and small grain, 1 year of beans and cultivated fallow to kill weeds, and 3 or 4 years of alfalfa. Flood or furrow irrigation is used for beans grown on most of the soils of the young alluvial fans and flood plains. The acreage planted in the county varies considerably from year to year, depending mainly on the price. The yield for the county averages 1,000 pounds per acre. Yields of more than 1,800 pounds can be obtained regularly on deep, well drained soils if careful management is used. Suitable practices include subsoiling and good seedbed preparation, the use of certified seed, three light irrigations of 4 to 5 inches each (plus preirrigation when the beans are double cropped), provision for drainage of excess surface water, use of fungicides to prevent damping off, and use of insecticides for control of wireworms and insect pests.

Corn silage.—Corn is widely grown for silage on the dairy farms of the county. A total of 17,361 acres was cut for silage in 1959, according to the census. Soils used for corn include the well-drained and the imperfectly drained soils of the alluvial fans and flood plains, the basin soils affected only slightly by salts and alkali, and the hardpan soils of the San Joaquin and Madera series. Yields average about 11 tons of green matter per acre over the county, but they are as high as 20 to 25 tons under good management. Four to five irrigations are needed, plus dairy manure and nitrogen from commercial fertilizers. Sandy soils require lighter and more frequent applications of water and two applications of nitrogen, one before planting and one midway through the growing season.

Grapes.—Many varieties of wine, raisin, and table grapes are grown in Stanislaus County. Of the 19,675 acres reported in grapes by the census in 1959, more than half was in wine grapes, mainly Carignane, Alicante Bouschet, and Palomino varieties. Thompson seedless, used for raisins, wine, and table grapes, was grown on most of the rest. Table varieties were grown on a few hundred acres. Vineyards are almost entirely on soils of medium to coarse texture that are on the young alluvial fans. The average yield of wine grapes in the county is about 6 tons per acre; that of raisin and table grapes is about 7 tons per acre. The raisin and table grapes are all irrigated, but some of the wine grapes are grown without irrigation after the young plants are well established.

Much higher yields can be obtained by good management. If, however, the vines are forced to produce too heavily, the sugar content of the fruit declines to such low levels that the grapes cannot be marketed. Optimum yields per acre are probably about 10 tons of wine grapes and 12 to 14 tons of Thompson seedless on the better soils; yields are somewhat lower on very sandy soils.

The vines are commonly treated with zinc sprays to overcome a rather widespread zinc deficiency in the soils. Some barnyard manure or nitrogen fertilizer is usually applied in the fall or winter. Sandy soils are often infested with nematodes and should be treated with fumigants before the vines are planted.

Irrigated pasture.—Irrigated pasture is produced on almost every soil in the area for which water is available. In Stanislaus County 91,306 acres of irrigated pasture were reported in 1956. This crop is popular because of the ladino clover in the pasture mixture. Pastures containing ladino clover produce large quantities of nutritious forage over a period of years. With careful management, they support as many as two or three dairy cows or steers per acre from April to October. Clover pasture is very shallow rooted; therefore, the largest areas of irrigated pasture are grown on the shallow hardpan soils of the Madera and San Joaquin series in the vicinity of Oakdale (fig. 12). In this area, one can drive for miles and see no other crop. Clover pasture is also widely grown on imperfectly drained Dinuba soils and on saline-alkali soils of the basin area. It aids the reclamation of the saline-alkali soils.

Careful irrigation is the key to good pasture production. The soil should be made uniformly smooth, and water should be applied in small amounts every 7 to 14 days, depending upon the weather. Sprinkler irrigation should be employed where the slopes are too steep or irregular to be smoothed. Standing water should be prevented by drainage. Superphosphate should be applied in winter. Gypsum is required for soils containing alkali.

Peaches.—Plantings of clingstone peaches for canning increased rapidly after the Second World War. Accord-

***Figure 12.*—Irrigated ladino clover pasture is widely grown on San Joaquin soils. Fragments of hardpan have been exposed by subsoiling and leveling.**

ing to the Federal census, 30,903 acres were in peaches (clingstone and freestone) in 1959. Peaches are grown mainly on the deep, well-drained soils of the Hanford-Tujunga association. About 70 percent of the peaches are grown on Hanford soils of sandy loam or fine sandy loam texture, and 17 percent are grown on Tujunga and Delhi loamy sands. The remaining 13 percent are grown on various shallower or less well-drained soils. Yields average about 12 tons per acre for the county with good management. If well managed, orchards on the Hanford soils will produce consistent yields of 15 to 18 tons per acre. Yields can be maintained at about 20 tons per acre if the orchards on these soils are very carefully managed (fig. 13).

***Figure 13.*—Cling peaches produce large yields on the deep, permeable soils of the young alluvial fans, and often the branches must be supported by props. Soil is Hanford fine sandy loam.**

Successful peach growers provide ample but not excessive irrigation. They pay much attention to control of insects and other pests, to pruning, and to fruit thinning, and they cultivate only when necessary. These growers generally use nitrogen, supply zinc by spraying the trees, and grow green-manure crops during the winter.

It is particularly important to cultivate the soils when they are only slightly moist. If the soils are worked when moist, dense and slowly permeable plowsoles form and are very difficult to eliminate without injury to the tree roots.

Range pasture.—More than a third of Stanislaus County is used for range pasture. Beef cattle are the principal livestock, but some sheep and dairy cattle are raised. The pasture is grazed mainly from October to May; the stock is moved to irrigated pasture during the summer. Generally part of the winter feed is left ungrazed. This provides dry forage for the livestock in autumn until the first rains of the season start a new crop of grass.

The dark-colored clay soils of the Peters (fig. 14) and

***Figure 14.*—Soils formed from andesitic tuff, such as Peters clay (foreground) and Pentz gravelly loam (background), are prized as range because of the highly nutritious forage produced.**

Raynor series are highly prized as range in the eastern part of the county. They support a good growth of burclover, and the livestock grazing the range on these soils gain weight rapidly. The young alluvial soils along the streams also provide abundant forage.

Experiments now being carried on in range reseeding and fertilization are expected to increase materially the carrying capacity of many soils. The introduction of annual rose, crimson, and subterranean clovers and fertilization with gypsum and phosphate already show promising results on sandy rangeland soils (*5*). Nitrogen fertilizer is also used with good results in some places.

Irrigation and Drainage

Because summer rainfall is scant, the intensive agriculture of the Area depends almost entirely on irrigation. The importance of irrigation was recognized as early as 1854 by a surveyor, Silas Wilcox (*6*). Irrigation, however, did not begin until 1901, when the Turlock Irrigation District started operations. In that year 3,757 acres were irrigated with water diverted from the Tuolumne River at a dam near La Grange. Irrigation proved to be so profitable that now four irrigation districts serve the Area (fig. 15). Water is obtained from the Tuolumne and Stanislaus Rivers, stored behind large dams, and delivered to the farms by hundreds of miles of canals (fig. 16). Further development is in progress; three new dams are under construction on the Stanislaus River, and an immense new dam is planned on the Tuolumne River.

Irrigation water is applied to the soil by flooding, furrows, or sprinklers, depending on the crop grown, the permeability of the soil, the slope, and the economic factors. Sprinklers are employed mainly on rolling soils

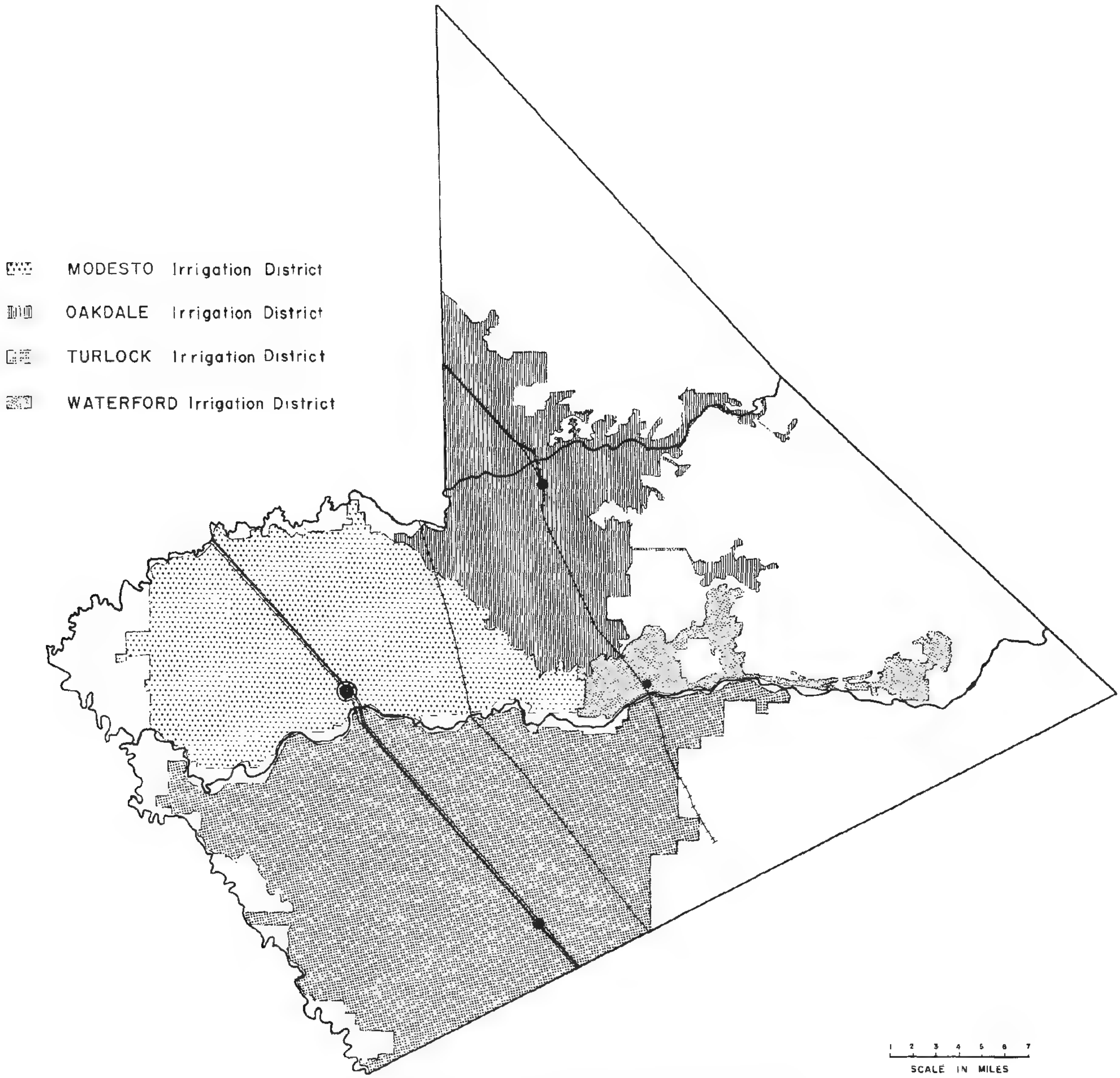

Figure 15.—Irrigation districts in Eastern Stanislaus County.

or very rapidly permeable sandy soils; furrows are used with row crops, vineyards, and other crops where the soil is slowly permeable. On level soil, crops are mainly grown with flood irrigation that is controlled by small ridges or checks. Checks used for the irrigation of most crops are generally 40 to 100 feet apart and 660 to 1,320 feet long on medium-textured soils, and 330 to 660 feet long on loamy sand and sand. The shorter runs are most suitable for providing uniform water penetration across the field. On irrigated pasture, runs up to 2,600 feet long are used, with checks 15 to 30 feet apart, but better water distribution is obtained with runs of 1,320 feet or less.

The average amounts of water applied each month are shown in figure 17, as well as the amounts used by crops, based on an efficiency factor of 70 percent. Comparison of figure 17 and figure 27 (p. 152) indicates good agreement between the calculated moisture deficit and the average amount of water used by crops.

Virtually all of the level land suited to irrigation has been developed. As more water is made available, how-

Figure 16.—Irrigation water is distributed throughout the several irrigation districts by extensive systems of canals.

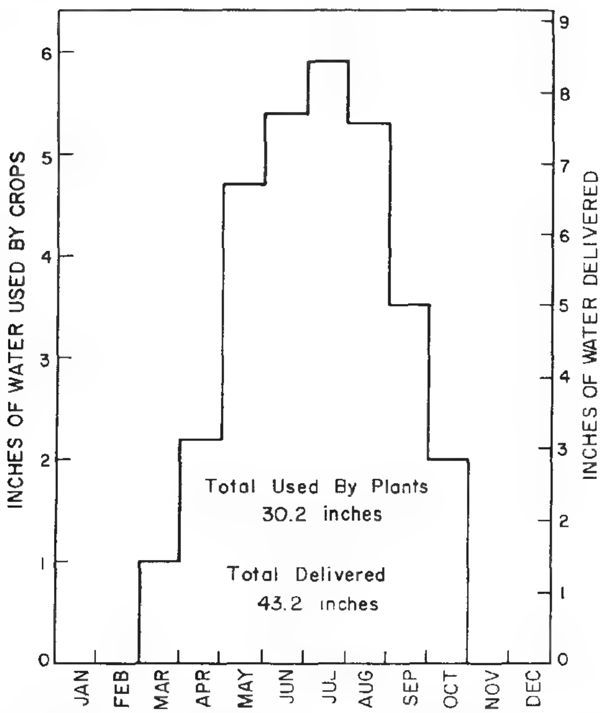

Figure 17.—Average monthly consumption (1952–1954) of irrigation water by crops in the Modesto Irrigation District, based on an irrigation efficiency factor of 70 percent.

ever, the rolling land in the eastern part of the Area will probably be irrigated. Sprinkler or contour-furrow irrigation is best suited to this kind of land.

Saline and Saline-Alkali Soils

Soils containing enough salts to affect plant growth are an important problem in an area of about 75 square miles. These soils extend eastward from the San Joaquin River for 1 to 7 miles; isolated spots occur farther east along the Southern Pacific Railroad and on the bottom lands of the Stanislaus and Tuolumne Rivers. The distribution of saline and saline-alkali soils is shown in figure 18.

Saline soils (those containing salts) occur only on the bottom lands of the San Joaquin River in the Eastern Stanislaus Area. Temple soils, and Columbia soils deposited over Temple soil material, are most commonly affected.

The saline soils can be partially leached of salt with relative ease, and many areas are successfully used for field crops and alfalfa. The depth of the water table, however, fluctuates with the rise and fall of the level of the river, and the reappearance of salts in the soils is still a hazard. Complete reclamation of these soils will not be possible until the flow of water in the San Joaquin River and its tributaries is brought under better control. In the meantime, the salts can be kept to a reasonable depth by careful irrigation. Enough water should be used to keep the salts leached to a depth below the root zone. The water table should be kept as far below the surface as possible when the river is low. Drainage ditches that empty into the river through trap valves or pumps are used for this purpose.

Three classes of saline soils were mapped: *Slightly saline*, *moderately saline*, and *strongly saline*. The slightly saline soils contain 0.15 to 0.35 percent salt (electrical conductivity of saturation extract of 4 to 8 millimhos per centimeter). Salt-tolerant crops can be grown successfully on these soils, but not salt-sensitive crops. The moderately saline soils contain 0.35 to 0.65 percent salt (8 to 15 millimhos per centimeter). Even salt-tolerant crops have somewhat reduced growth on these soils. The strongly saline soils contain over 0.65 percent salt (more than 15 millimhos per centimeter). No crops can be grown successfully on these soils without reclamation. In this Area, 2,873 acres were mapped as slightly saline, 1,695 acres as moderately saline, and 9 acres as strongly saline.

Saline-alkali soils (those containing salts and adsorbed sodium, or alkali) occur throughout the basin lands east of the San Joaquin River, particularly in the Waukena-Fresno association. Areas of Dinuba and Hilmar soils that occur where the water table is relatively high are also saline-alkali.

The saline-alkali soils are more difficult to reclaim than those containing only salts. Alkali is difficult to remove by leaching because the soils tend to disperse and seal up; sodium remains tightly adsorbed by the clay in the soil. Soil amendments, such as gypsum or sulfur, are required to replace the sodium. The amount of amendment required depends upon the amount of adsorbed sodium present and the amount of clay in the soil. In order to determine the amount of amendment required, the Stanislaus County Agricultural Extension Service has facilities for determining the gypsum requirement of saline-alkali soils, and will make this determination upon request. Good drainage must be established before reclamation is attempted.

Three classes of saline-alkali soils were mapped: *Slightly saline-alkali*, *moderately saline-alkali*, and *strongly saline-alkali*. From 5 to 20 percent of the area of slightly saline-alkali soils is affected by salts and alkali. Only salt-tolerant crops can be grown on these soils with moderate to good success. From 20 to 70 percent of the area of moderately saline-alkali soils is affected by salts and alkali. Irrigated pasture can be grown with limited success on these soils, but other crops should await alkali reclamation. More than 70 percent of the area of strongly

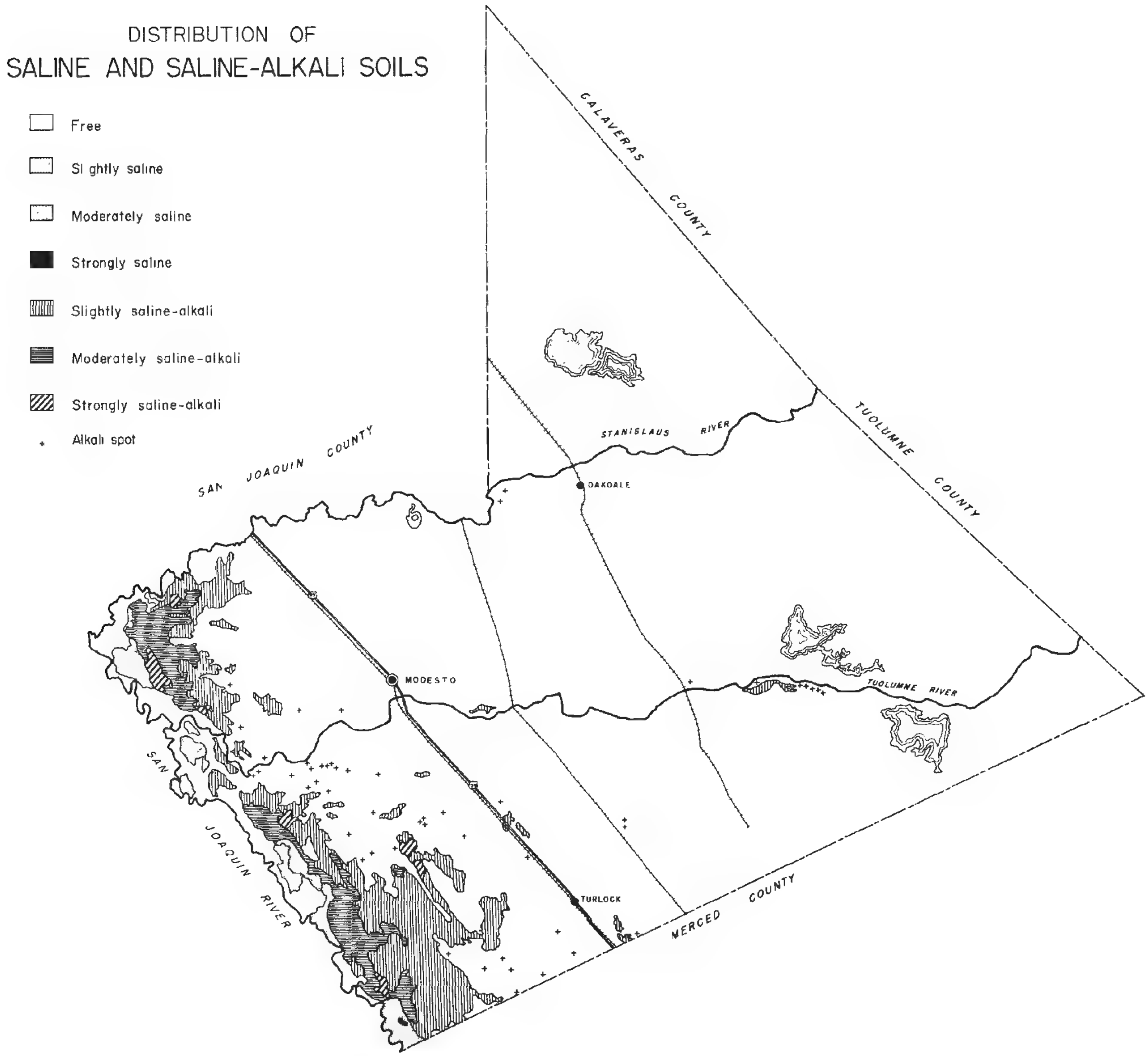

Figure 18.—**Distribution of saline and saline-alkali soils.**

saline-alkali soils is affected by salts and alkali. No crops can be successfully grown on these soils without reclamation. In this Area, 22,212 acres were mapped as slightly saline-alkali, 8,171 acres as moderately saline alkali, and 2,592 acres as strongly saline-alkali.

Before a reclamation program is started, careful consideration should be given to the costs of establishing good drainage, the soil amendments needed, and the length of time there will be no profitable return from the soil. Special consideration should be given to the problems of leaching soils that have a hardpan or a slowly permeable subsoil.

Soil Profile Groups, Land Type Groups, and Index Ratings [3]

The nature of a large number of soils is more easily remembered if the soils that have similar properties and qualities are grouped. The kind of profile, the natural land type grouping, and the index rating and grade are given for each soil in table 3. An explanation of the groupings and of the rating and grading factors follows.

[3] By R. Earl Storie, professor of soils and plant nutrition, emeritus, University of California, Berkeley.

Soil profile groups

Soil profile groups are made on the basis of (1) position, (2) degree to which profile development is expressed, and (3) the kind of underlying material.

Nine profile groups are recognized in the Eastern Stanislaus Area (see table 3). Group I consists of recent alluvium and eolian soils having no horizon differentiation. The next five groups have increasing amounts of clay in the subsoil. Group II soils have weakly expressed horizons, and group III soils have moderately expressed horizons. Group IV soils have strongly expressed claypan subsoils, and group V soils have hardpan subsoils. Group VI soils have claypans underlain by partially consolidated substrata. A small letter "x" following a Roman numeral, as Ix, IIx, and IIIx, indicates that the soil profile is underlain by a substratum unrelated to the soil above.

In groups VII, VIII, and IX are soils of the uplands. The group number indicates the nature of the underlying rock. Group VII soils are underlain by hard igneous rocks, group VIII soils by hard sedimentary rocks, and group IX soils by relatively soft rocks of all kinds.

TABLE 3.—*Soil profile groups, natural land types, and Storie index*

Map symbol	Soil	Soil profile group	Natural land type	Storie index					
				Rating factors—				Index rating	Grade
				Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)		
AcA	Alamo clay, 0 to 1 percent slopes	V	C_{14}	30	60	100	100	18	5
AgB	Amador gravelly loam, 0 to 8 percent slopes	IX	E_{5-4p}	30	70	90	40	8	6
AmB	Amador loam, 0 to 8 percent slopes	IX	E_{5-4p}	30	95	90	40	10	5
AmD	Amador loam, 8 to 30 percent slopes	IX	E_{5-4p}	30	95	75	40	9	6
AmF	Amador loam, 30 to 60 percent slopes	IX	E_{13}	20	95	40	40	3	6
AnA	Anderson gravelly fine sandy loam, 0 to 3 percent slopes.	I	A_7	100	70	100	90	63	2
AnB	Anderson gravelly fine sandy loam, 3 to 8 percent slopes.	I	A_7	100	70	90	90	57	3
AoA	Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes.	I	A_{7-5ch}	100	60	100	40	24	4
AuB	Auburn clay loam, 3 to 8 percent slopes	VII	E_5	35	80	95	100	27	4
AuD	Auburn clay loam, 8 to 20 percent slopes	VII	E_5	35	75	80	100	21	4
BmA	Bear Creek loam, 0 to 3 percent slopes	IIIx	A_2	80	100	100	80	64	2
BgA	Bear Creek gravelly loam, 0 to 3 percent slopes	IIIx	A_8	80	80	100	80	51	3
BcA	Bear Creek clay loam, 0 to 3 percent slopes	IIIx	A_{2-1p}	80	85	100	80	54	3
BeA	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes.	IIIx	A_{8-5ch}	80	70	100	50	28	4
CaA	Chualar sandy loam, 0 to 3 percent slopes	III	A_2	80	95	100	100	76	2
CbA	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes.	III	A_{2-2s}	80	95	100	70	53	3
CcA	Columbia fine sandy loam, 0 to 1 percent slopes	I	A_{1-1o}	100	100	100	85	85	1
CdA	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes.	I	$A_{1-1o-2m}$	100	100	100	55	55	3
CfA	Columbia silt loam, 0 to 1 percent slopes	I	A_{1-1o}	100	100	100	85	85	1
CgA	Columbia silt loam, slightly saline, 0 to 1 percent slopes	I	$A_{1-1o-2s}$	100	100	100	80	80	1
CkA	Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes.	Ix	$A_{1\ 1o}$	95	100	100	85	81	1
CmA	Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes.	Ix	$A_{1-1o-2s}$	95	100	100	80	76	2
CeA	Columbia loam, 0 to 1 percent slopes	I	$A_{1\ 1o}$	100	100	100	85	85	1
ChA	Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes.	Ix	$A_{1-1o-2s}$	75	100	100	70	53	3
CoA	Columbia silty clay loam, slightly saline, 0 to 1 percent slopes.	I	$A_{1-1o-2s}$	100	90	100	75	68	2
CpA	Columbia soils, 0 to 1 percent slopes	I	A_{1-1o}	100	70	100	85	60	2
CsB	Columbia soils, channeled, 0 to 8 percent slopes	I	$A_{1\ 1o-5ch}$	------	------	------	------	35	4
CyB	Corning gravelly sandy loam, 3 to 8 percent slopes	IV	D_{12}	70	60	90	90	34	4
CyC	Corning gravelly sandy loam, 8 to 15 percent slopes	IV	D_{24}	70	60	85	90	32	4
CyD	Corning gravelly sandy loam, 15 to 30 percent slopes	IV	D_{24-3m}	70	60	75	70	22	4
DhA	Delhi sand, 0 to 3 percent slopes	I	A_{5-3m}	100	60	95	85	48	3
DhB	Delhi sand, 3 to 8 percent slopes	I	A_{5-3m}	100	60	90	85	46	3
DeA	Delhi loamy sand, 0 to 3 percent slopes	I	A_{5-3m}	100	80	100	85	68	2
DeB	Delhi loamy sand, 3 to 8 percent slopes	I	A_{5-3m}	100	80	90	85	61	2
DgA	Delhi loamy sand, silty substratum, 0 to 3 percent slopes.	Ix	A_{6-3m}	95	90	95	90	73	2

See footnotes at end of table.

TABLE 3.—*Soil profile groups, natural land types, and Storie index*—Continued

Map symbol	Soil	Soil profile group	Natural land type	Storie index: Rating factors—Factor A (profile)	Storie index: Rating factors—Factor B (texture)	Storie index: Rating factors—Factor C (slope)	Storie index: Rating factors—Factor X (other conditions)	Storie index: Index rating	Storie index: Grade
DfA	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes.	Ix	A_{6-3m}	95	80	100	85	65	2
DkA	Dello loamy sand, 0 to 1 percent slopes	I	A_{5-1p}	100	80	100	80	64	2
DrA	Dinuba sandy loam, 0 to 1 percent slopes	IIx	A_2	90	95	100	90	77	2
DtA	Dinuba sandy loam, deep, 0 to 1 percent slopes	IIx	A_2	95	95	100	90	81	1
DsA	Dinuba sandy loam, shallow, 0 to 1 percent slopes	IIx	A_2	50	95	100	90	43	3
DuA	Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes.	IIx	A_{2-1p}	90	95	100	80	68	2
DwA	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	IIx	A_{2-2s}	90	95	100	70	60	2
DxA	Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	IIx	A_{2-2m}	90	95	100	30	26	4
DyA	Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes.	IIx	A_{2-2s}	50	95	100	70	33	4
DzA	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes.	IIx	$A_{2-1p-2s}$	90	95	100	14	12	5
DmA	Dinuba fine sandy loam, 0 to 1 percent slopes	IIx	A_2	90	100	100	90	81	1
DoA	Dinuba fine sandy loam, deep, 0 to 1 percent slopes	IIx	A_2	95	100	100	90	86	1
DnA	Dinuba fine sandy loam, shallow, 0 to 1 percent slopes	IIx	A_2	60	100	100	90	54	3
DpA	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	IIx	A_{2-2s}	90	100	100	70	63	2
Dl	Dredge and mine tailings	----	A_{14}	----	----	----	----	<5	6
EcF	Exchequer rocky loam, 30 to 60 percent slopes	VII	E_{16}	30	65	35	100	7	6
ExB	Exchequer and Auburn soils, 3 to 8 percent slopes	VII	E_5	35	85	95	100	28	4
ExD	Exchequer and Auburn soils, 8 to 30 percent slopes	VII	E_5	35	80	80	100	22	4
ErD	Exchequer and Auburn rocky soils, 8 to 30 percent slopes.	VII	E_8	35	70	80	100	20	4
FoA	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes.	I	$A_{1-1p-2s}$	100	100	100	30	30	4
FtA	Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	V	B_{13-2s}	40	95	100	70	27	4
FuA	Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	V	B_{13-2m}	40	95	100	30	11	5
FvA	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	V	B_{13-2a}	40	95	100	15	6	6
FpA	Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	V	B_{13-2s}	40	100	100	70	28	4
FrA	Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	V	B_{13-2m}	40	100	100	30	12	5
FsA	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	V	B_{13-2a}	40	100	100	15	6	6
FwA	Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes.	----	B_{13-2s}	----	----	----	----	35	4
FxA	Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes.	----	B_{13-2m}	----	----	----	----	17	5
GhA	Grangeville sandy loam, 0 to 1 percent slopes	I	A_{1-1o}	100	95	100	85	81	1
GkA	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes	I	$A_{1-1o-2s}$	100	95	100	70	67	2
GfA	Grangeville fine sandy loam, 0 to 1 percent slopes	I	A_{1-1o}	100	100	100	85	85	1
GgA	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	I	$A_{1-1o-2s}$	100	100	100	70	70	2
GmA	Grangeville very fine sandy loam, 0 to 1 percent slopes	I	A_{1-1o}	100	100	100	85	85	1
GnA	Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	I	$A_{1-1o-2s}$	100	100	100	59	59	3
GoA	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	I	$A_{1-1o-2m}$	100	100	100	24	24	4
GsA	Greenfield sandy loam, 0 to 3 percent slopes	II	A_1	95	95	100	100	90	1
GrA	Greenfield fine sandy loam, 0 to 3 percent slopes	II	A_1	95	100	100	100	95	1
GsB	Greenfield sandy loam, 3 to 8 percent slopes	II	C_1	95	95	90	95	77	2
GvA	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes.	IIx	A_9	75	95	95	100	68	2
HdA	Hanford sandy loam, 0 to 3 percent slopes	I	A_1	100	95	100	100	95	1
HdB	Hanford sandy loam, 3 to 8 percent slopes	I	A_1	100	95	95	100	90	1
HdC	Hanford sandy loam, 8 to 15 percent slopes	I	A_1	100	95	80	100	76	2

See footnotes at end of table.

TABLE 3.—*Soil profile groups, natural land types, and Storie index*—Continued

Map symbol	Soil	Soil profile group	Natural land type	Storie index: Rating factors— Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
HddA	Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes.	I	A_{1-1p}	100	95	100	80	76	2
HdmA	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes.	I	A_{16}	85	95	100	90	73	2
HcA	Hanford gravelly sandy loam, 0 to 3 percent slopes	I	A_{7}	100	70	100	100	70	2
HbA	Hanford fine sandy loam, 0 to 3 percent slopes	I	A_{1}	100	100	100	100	100	1
HbmA	Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes.	I	A_{16}	85	100	100	90	77	2
HeA	Hanford very fine sandy loam, 0 to 1 percent slopes	I	A_{1-1o}	100	100	100	90	90	1
HdpA	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes.[1]	Ix	A_{1}	95	95	100	100	90	1
HdsA	Hanford sandy loam, deep over silt, 0 to 1 percent slopes.[1]	Ix	A_{1}	100	95	100	100	95	1
HbpA	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes.[1]	Ix	A_{1}	95	100	100	100	95	1
HbsA	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes.[1]	Ix	A_{1}	100	100	100	100	100	1
HmA	Hilmar sand, 0 to 3 percent slopes	Ix	A_{6-3m}	90	70	95	85	51	3
HfA	Hilmar loamy sand, 0 to 1 percent slopes	Ix	A_{6-3m}	90	90	95	90	69	2
HfdA	Hilmar loamy sand, deep, 0 to 1 percent slopes	Ix	A_{6-3m}	95	90	95	90	73	2
HkaA	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes.	Ix	$A_{6-1p-2s}$	90	90	100	56	45	3
HkbA	Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes.	Ix	A_{6-2s}	90	90	100	70	57	3
HfeA	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes.	Ix	$A_{6-1p-2m}$	90	90	100	15	12	5
HrA	Honcut sandy loam, 0 to 1 percent slopes	I	A_{1}	100	95	100	100	95	1
HoA	Honcut fine sandy loam, 0 to 1 percent slopes	I	A_{1}	100	100	100	100	100	1
HpA	Honcut loam, 0 to 1 percent slopes	I	A_{1}	100	100	100	100	100	1
HnA	Honcut clay loam, 0 to 1 percent slopes	I	A_{1}	100	90	100	100	90	1
HuA	Hopeton loam, 0 to 3 percent slopes	IV	D_{9}	70	100	100	80	56	3
HuB	Hopeton loam, 3 to 8 percent slopes	IV	D_{9}	70	100	95	80	53	3
HtA	Hopeton clay loam, 0 to 3 percent slopes	IV	D_{9}	70	85	100	80	48	3
HtB	Hopeton clay loam, 3 to 8 percent slopes	IV	D_{9}	70	85	95	80	45	3
HsB	Hopeton clay, 3 to 8 percent slopes	IV	D_{10}	70	60	95	80	32	4
HvB	Hornitos fine sandy loam, 3 to 8 percent slopes	IX	E_{5-4p}	30	100	90	50	14	5
HvD	Hornitos fine sandy loam, 8 to 30 percent slopes	IX	E_{5-4p}	30	100	75	50	11	5
HyB	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes.	IX	E_{5-4p}	30	70	90	50	9	5
HyD	Hornitos gravelly fine sandy loam, 8 to 30 percent slopes.	IX	E_{5-4p}	30	70	75	50	8	6
KgB	Keyes gravelly clay loam, 0 to 8 percent slopes	V	D_{28-4p}	30	65	95	70	13	5
KeB	Keyes cobbly clay loam, 0 to 8 percent slopes	V	D_{28-4p}	30	55	95	90	14	5
La	Lava and sandstone rockland	---	E_{17}	---	---	---	---	<5	6
MdA	Madera sandy loam, 0 to 2 percent slopes	V	C_{13}	35	95	100	90	30	4
MdB	Madera sandy loam, 2 to 4 percent slopes	V	C_{13}	35	95	90	90	27	4
MaA	Madera loam, 0 to 2 percent slopes	V	C_{13}	35	100	100	90	32	4
MeA	Madera-Alamo complex, 0 to 2 percent slopes	V	$C_{13,14}$	30	80	100	90	22	4
MkA	Meikle clay, 0 to 1 percent slopes	III	C_{4-1p}	70	60	100	50	21	4
MoA	Modesto loam, 0 to 1 percent slopes	III	A_{2}	80	100	100	90	72	2
MpA	Modesto loam, slightly saline-alkali, 0 to 1 percent slopes.	III	B_{2-2s}	70	100	100	70	49	3
MmA	Modesto clay loam, 0 to 1 percent slopes	III	A_{2}	80	85	100	90	61	2
MnA	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes.	III	B_{2-2s}	70	80	100	70	39	4
MtA	Montpellier coarse sandy loam, 0 to 3 percent slopes	III	D_{9}	70	90	100	90	57	3
MvA	Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes.	III	D_{9-1p}	70	90	100	70	44	3
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes	III	D_{9}	70	90	90	90	51	3
MtC	Montpellier coarse sandy loam, 8 to 15 percent slopes	III	D_{21}	70	90	80	90	45	3
MtC2	Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded.	III	D_{21-3m}	70	90	80	80	40	3
MtD2	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded.	III	D_{21-3m}	70	90	70	70	31	4

TABLE 3.—*Soil profile groups, natural land types, and Storie index*—Continued

Map symbol	Soil	Soil profile group	Natural land type	Storie index: Rating factors—Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
MtD3	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded.	III	D_{21-3b}	70	90	70	50	22	4
OaA	Oakdale sandy loam, 0 to 3 percent slopes	II	A_1	95	95	100	100	90	1
PaA	Paulsell clay, 0 to 1 percent slopes	III	C_4	80	65	100	100	52	3
PcB	Pentz cobbly loam, very shallow, 0 to 8 percent slopes	IX	E_8	10	60	95	100	6	6
PcD	Pentz cobbly loam, very shallow, 8 to 30 percent slopes	IX	E_8	10	60	80	100	5	6
PmB	Pentz loam, moderately deep, 3 to 8 percent slopes	IX	E_1	70	100	90	100	63	2
PmC	Pentz loam, moderately deep, 8 to 15 percent slopes	IX	E_1	70	100	80	100	56	3
PmC2	Pentz loam, moderately deep, 8 to 15 percent slopes, eroded.	IX	E_{1-3m}	70	100	80	90	50	3
PmD	Pentz loam, moderately deep, 15 to 30 percent slopes	IX	E_1	70	100	75	95	50	3
PmD2	Pentz loam, moderately deep, 15 to 30 percent slopes, eroded.	IX	E_{1-3m}	70	100	70	70	34	4
PoB	Pentz sandy loam, 3 to 8 percent slopes	IX	E_5	50	95	90	90	38	4
PfB	Pentz loam, 3 to 8 percent slopes	IX	E_5	30	100	90	90	24	4
PfD	Pentz loam, 8 to 30 percent slopes	IX	E_5	30	100	80	90	22	4
PfE	Pentz loam, 30 to 45 percent slopes	IX	E_{13}	20	100	40	90	7	6
PeB	Pentz gravelly loam, 3 to 8 percent slopes	IX	E_5	30	70	90	90	17	5
PeD	Pentz gravelly loam, 8 to 30 percent slopes	IX	E_5	30	70	80	90	15	5
PeF	Pentz gravelly loam, 30 to 75 percent slopes	IX	E_{13}	20	70	30	90	4	6
PpB	Pentz-Redding gravelly loams, 0 to 8 percent slopes	IX, V	E_8	30	70	95	85	17	5
PtB	Peters clay, 0 to 8 percent slopes	IX	E_6	40	60	90	90	19	5
PtC	Peters clay, 8 to 15 percent slopes	IX	E_6	40	60	85	90	18	5
PvB	Peters cobbly clay, 0 to 8 percent slopes	IX	E_6	40	50	90	90	16	5
PvC	Peters cobbly clay, 8 to 15 percent slopes	IX	E_6	40	50	85	90	15	5
PxB	Peters-Pentz complex, 0 to 8 percent slopes	IX	E_5, E_6					18	5
PxC	Peters-Pentz complex, 8 to 15 percent slopes	IX	E_5, E_6					16	5
RaA	Raynor clay, 0 to 3 percent slopes	IX	E_2	70	60	100	100	42	3
RaB	Raynor clay, 3 to 8 percent slopes	IX	E_2	70	60	95	100	40	3
RaC	Raynor clay, 8 to 15 percent slopes	IX	E_2	70	60	90	85	32	4
RbB	Raynor cobbly clay, 0 to 8 percent slopes	IX	E_2	70	50	95	100	33	4
RbC	Raynor cobbly clay, 8 to 15 percent slopes	IX	E_2	70	50	85	100	30	4
RdB	Redding gravelly loam, 0 to 8 percent slopes	V	D_{28-4p}	25	70	90	90	14	5
RcB	Redding cobbly loam, 0 to 8 percent slopes	V	D_{28-4p}	25	60	90	90	12	5
RcC	Redding cobbly loam, 8 to 15 percent slopes	V	D_{32-4p}	25	60	80	90	11	5
Rr	Riverwash		A_{14}					<5	6
ReA	Rocklin sandy loam, 0 to 3 percent slopes	IX, V	D_{25}	50	95	95	95	43	3
ReB	Rocklin sandy loam, 3 to 8 percent slopes	IX, V	D_{25}	50	95	90	95	41	3
RkA	Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2m}	60	85	100	30	15	5
RfA	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes.	IV	B_{10-2m}	60	50	100	30	9	6
RgA	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes.	IV	B_{10-2a}	60	50	100	15	5	6
RnA	Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2m}	60	90	100	30	16	5
RoA	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2a}	60	90	100	15	8	6
RyA	Ryer loam, 0 to 1 percent slopes	III	C_2	85	100	100	100	85	1
RvA	Ryer clay loam, 0 to 1 percent slopes	III	C_2	85	85	100	100	72	2
RtA	Ryer clay, 0 to 1 percent slopes	III	C_4	85	65	100	100	55	3
SaA	San Joaquin sandy loams, 0 to 3 percent slopes	V	C_{13}	30	95	95	90	24	4
SaB	San Joaquin sandy loams, 3 to 8 percent slopes	V	C_{13}	30	95	90	90	23	4
SmA	San Joaquin and Madera soils, 0 to 3 percent slopes	V	C_{13}	35	95	95	90	28	4
Sc	Schist rockland		E_{17}					<5	6
SnA	Snelling sandy loam, 0 to 3 percent slopes	III	C_2	90	95	100	100	86	1
SwA	Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes.	III	C_{2-1p}	90	95	100	80	68	2
SnB	Snelling sandy loam, 3 to 8 percent slopes	III	C_2	90	95	90	100	77	2
TgA	Temple silty clay loam, 0 to 1 percent slopes	II	B_{1-1o}	95	90	100	80	68	2
ThA	Temple silty clay loam, slightly saline, 0 to 1 percent slopes.	II	$B_{1-1o-2s}$	95	90	100	70	60	2
TkA	Temple silty clay loam, moderately saline, 0 to 1 percent slopes.	II	$B_{1-1o-2m}$	95	90	100	55	47	3
TbA	Temple loam, overwashed, 0 to 1 percent slopes	II	B_{1-1o}	95	100	100	80	76	2

See footnotes at end of table.

TABLE 3.—*Soil profile groups, natural land types, and Storie index*—Continued

Map symbol	Soil	Soil profile group	Natural land type	Storie index: Rating factors: Factor A (profile)	Factor B (texture)	Factor C (slope)	Factor X (other conditions)	Index rating	Grade
TcA	Temple loam, overwashed, slightly saline, 0 to 1 percent slopes.	II	$B_{1-10-2s}$	95	100	100	70	67	2
TdA and CnA	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes.	II	$B_{1-10-2m}$	95	100	100	50	48	3
TeA	Temple silty clay, slightly saline, 0 to 1 percent slopes.	II	$B_{3-10-2s}$	95	80	100	65	49	3
TfA	Temple silty clay, moderately saline, 0 to 1 percent slopes.	II	$B_{3-10-2m}$	95	80	100	50	38	4
Tx	Terrace escarpments		A_{14}					<5	6
HaB	Toomes rocky loam, 0 to 8 percent slopes	VII	E_8	20	60	95	100	11	5
TpA	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	II	B_{1-2s}	90	95	100	70	60	2
TrA	Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	II	B_{1-2m}	90	95	100	30	26	4
TsA	Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	II	B_{1-2a}	90	95	100	15	13	5
TmA	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	II	B_{1-2s}	90	100	100	70	63	2
TnA	Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	II	B_{1-2m}	90	100	100	30	27	4
ToA	Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	II	B_{1-2a}	90	100	100	15	14	5
Tt	Tuff rockland		E_{17}					<5	6
TuA	Tujunga loamy sand, 0 to 3 percent slopes	I	A_5	100	80	100	95	76	2
TuB	Tujunga loamy sand, 3 to 5 percent slopes	I	A_5	100	80	95	95	72	2
TvA	Tujunga sand, 0 to 3 percent slopes	I	A_{5-10}	85	50	100	100	[2] 43	3
WdA	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2s}	60	95	100	60	34	4
WeA	Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2m}	60	95	100	30	17	5
WaA	Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2s}	60	100	100	60	36	4
WbA	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2m}	60	100	100	30	18	5
WcA	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	IV	B_{9-2a}	60	100	100	10	6	6
WkB	Whiterock silt loam, 0 to 8 percent slopes	VIII	E_5	25	85	95	100	20	4
WhD	Whiterock rocky silt loam, 8 to 30 percent slopes	VIII	E_8	20	65	80	100	10	5
WhF	Whiterock rocky silt loam, 30 to 60 percent slopes	VIII	E_{16}	20	65	40	100	5	6
WmB	Whitney sandy loams, 3 to 8 percent slopes	IX	E_1	70	95	90	100	60	2
WmC	Whitney sandy loams, 8 to 15 percent slopes	IX	E_1	70	90	80	100	50	3
WmD	Whitney sandy loams, 15 to 30 percent slopes	IX	E_1	70	95	70	100	47	3
WmC2	Whitney sandy loams, 8 to 15 percent slopes, eroded	IX	E_{1-3m}	70	95	80	80	43	3
WmD2	Whitney sandy loams, 15 to 30 percent slopes, eroded	IX	E_{1-3m}	70	95	70	70	33	4
WmE2	Whitney sandy loams, 30 to 45 percent slopes, eroded	IX	E_{9-3m}	70	95	40	85	23	4
WrA	Whitney and Rocklin sandy loams, 0 to 3 percent slopes.	IX	D_{25}					50	3
WrB	Whitney and Rocklin sandy loams, 3 to 8 percent slopes.	IX	D_{25}					48	3
WrC	Whitney and Rocklin sandy loams, 8 to 15 percent slopes.	IX	D_{29}					45	3
WvA	Wyman loam, 0 to 1 percent slopes	II	A_1	95	100	100	100	95	1
WyA	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes.	II	A_{16}	85	100	100	100	85	1
WtA	Wyman clay loam, 0 to 1 percent slopes	II	A_1	95	85	100	100	81	1
YkA	Yokohl loam, 0 to 1 percent slopes	V	C_{13}	35	100	100	90	32	4
YoA	Yokohl clay loam, 0 to 3 percent slopes	V	C_{13}	35	85	100	90	27	4
ZaB	Zaca clay, 3 to 8 percent slopes	IX	E_6	50	70	95	100	33	4
ZaC	Zaca clay, 8 to 15 percent slopes	IX	E_6	50	70	90	100	32	4
ZaD	Zaca clay, 15 to 30 percent slopes	IX	E_6	50	70	75	100	23	4

[1] This mapping unit was described under the series name "Ripperdan" in University of California Soil Survey Report No. 13, "Soils of Eastern Stanislaus County, California," (*3*) and in some other University of California publications.

[2] On flood plains subject to flooding, the Storie index is 30.

Natural land types

The soils that are similar in position in the landscape, surface texture, slope, depth, permeability, drainage, salt and alkali content, erosion conditions, and microrelief are placed in five major natural land type groups (see table 3). These are: A, alluvial fans and flood plains; B, basins; C, lower terraces; D, higher terraces; and E, uplands. Surface texture, subsoil density, depth, and broad slope groups are shown by subscripts. For example, A_1 means that the soil so designated occupies an alluvial fan and has a medium-textured surface soil and a deep, permeable profile; $B_{12\text{-}2a}$ means that the soil occupies a basin position (B), has a medium-textured surface underlain by a hardpan (subscript 12), and contains a strong amount of alkali (subscript 2a). Further explanation of the symbols is given in "Real Property Appraisal Memorandum, Part IV, Rural Appraisal" (pages 8 through 31), issued November 20, 1940, by the State Board of Equalization, Division of Assessment Standards, Sacramento, Calif. Natural land type groupings are included in table 3 for the benefit of appraisers using this classification for tax appraisal purposes.

Storie index ratings and soil grades

The Storie index ratings (see table 3) provide a comparative evaluation of the general suitability of the soils for agriculture (*14*). They are based on four factors that represent the inherent characteristics and qualities of the soils. Each factor is rated or evaluated separately in terms of percentage of the ideal, or 100 percent.

Factor A—Profile characteristics. Factor A expresses relative favorability of the profile to the growth of plant roots. Soils that have a deep, friable profile are rated 100 percent. Those that have a dense clay layer or a hardpan or are shallow over bedrock are rated less than 100 percent. The rating depends upon the extent to which root penetration is limited.

Factor B—Texture of the surface soil. Factor B is rated according to the texture of the surface soil, which is important in determining how easily the soil can be worked and how easily crops can be established. The moderately coarse and medium textures -fine sandy loam, loam, and silt loam—are the most favorable and are rated as 100 percent. The coarser and finer textures are rated less than 100 percent.

Factor C—Slope. Factor C is particularly important if the soil is irrigated. Smooth, very gently sloping soils are rated 100 percent. The rating decreases as the slope increases.

Factor X—Other conditions. Factor X is used to evaluate any limitations on the use of the soil, such as imperfect or poor drainage, salts or alkali, erosion, low natural fertility, or unfavorable microrelief. If more than one limitation exists, the values for each are multiplied together to get the rating for the X factor.

The index is obtained by multiplying together the values of the four factors. $A \times B \times C \times X =$ Storie index.

The Storie index is calculated on the basis of soil properties and qualities alone. Land values, climate, location, markets, and other economic factors are not taken into account.

The soils are arranged in grades according to their suitability for general intensive agriculture, as shown by their Storie index ratings. The six grades and their range in index ratings follow.

	Range in index ratings
Grade 1	80 to 100
Grade 2	60 to 79
Grade 3	40 to 59
Grade 4	20 to 39
Grade 5	10 to 19
Grade 6	Less than 10

Soils of grades 1 and 2 are suitable for a fairly wide range of crops and have few special management needs. Soils of grade 3 are suited to few crops or to special crops.

Soils of grade 4 have a narrow range of agricultural possibilities. If used for crops, they are exacting in management requirements. Soils of grade 5 are generally suited only to range. Soils of grade 6 are generally nonagricultural; they furnish less grazing than the soils of grade 5.

Capability Groups

Capability grouping is a system of classification that shows the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs, limitations, and risks of damage to the soils and also on their response to management. There are three levels above the soil mapping unit in this grouping—the capability unit, the subclass, and the class.

The capability unit, which can also be called a management group of soils, is the first level in which kinds of soils are grouped in this system. A capability unit is ordinarily a group of soils that are similar in management needs, in risk of damage, and in general suitability for use. It can consist of just one soil.

The next broader grouping, the subclass, indicates the dominant kind of limitation. The letter symbol *e* means that the main limiting factor is risk of erosion if the plant cover is not maintained. The symbol *w* means that excess water retards plant growth or interferes with cultivation. The symbol *s* means that the soils are shallow, droughty, or low in fertiilty.

The broadest grouping, the class, is identified by Roman numerals. All the soils in one class have limitations and management problems of about the same degree, but they can be of different kinds. There are eight of these general classes in this system. All of the classes, except class I, may have one or more subclasses.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of the usual annual or short-lived crops. Soils in some of the other classes, however, are well suited to certain special crops, and to some fruit, nut, or ornamental plants.

Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly, but they do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping and, consequently, need moderate care to prevent erosion. Other soils in class II may be slightly droughty, slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly, but they have a narrower range of use. They need more careful management than the soils of class II.

In class IV are soils that should be cultivated only under very careful management; for many soils this means only occasionally in a system that includes several years of hay or other protective crops.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops but that can be used for pasture, for woodland, or for plants that shelter wildlife. Some of the soils in these classes, with substantial landforming or reclamation treatment, can be made suitable for special crops, or even changed to another capability class.

Class V soils are nearly level or gently sloping and are not likely to erode, but they are droughty, wet, low in fertility, or otherwise unsuitable for cultivation. There are none in this Area.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, or range, woodland, or wildlife. Some soils in class VI can, without damage, be cultivated enough so that fruit trees, forest trees, or ornamental plants can be set out or pasture crops seeded.

Class VII soils are more limited than class VI, and, as a rule, provide only poor to fair yields of forage. Yields of forest products may be fair to high. The soils have characteristics that severely limit their use for pasture and, in some places, for woodland.

In class VIII are soils that have practically no agricultural use. Some areas have value for watershed protection, wildlife shelter, or scenery.

The soils of the surveyed area have been placed in the capability classes, subclasses, and units as shown in the list that follows. A capability unit is usually a group of soils, similar in the main features that affect their use, conservation, and responses to management, within one capability class and subclass.

Capability units in California are given numbers that suggest the chief kind of limitation responsible for placement of the soils in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. The numerals used to designate units within the classes and subclasses are these:

1. An erosion hazard, actual or potential.
2. A problem or limitation caused by wetness.
3. A problem or limitation caused by limited soil depth.
4. A problem or limitation caused by coarse soil texture, excessive gravel, or rock outcrop.
5. A problem or limitation caused by fine soil texture.
6. A problem or limitation caused by excessive salt or alkali.
7. A problem or limitation caused by slow subsoil permeability.
8. A problem or limitation caused by salt and alkali, along with shallow soil.
9. A problem or limitation caused by low inherent fertility or low fertility as a result of erosion.

The capability classes, subclasses, and units in the Area are as follows:

Class I.—Soils that are very good for crops and have few limitations that restrict their use.
- Unit I–1.—Very deep, moderately coarse to moderately fine textured, permeable, nearly level, well-drained soils of the recent alluvial fans and flood plains.

Class II.—Soils that have some limitations that reduce the choice of plants or that require some conservation practices.
- Subclass IIe.—Soils that are likely to erode if not protected.
  - Unit IIe-1.—Very deep, moderately coarse textured, well-drained, gently sloping soils of the alluvial fans and flood plains.
- Subclass IIw.—Soils that have moderate limitations because of excess water.
  - Unit IIw–2.—Imperfectly to poorly drained, very deep, moderately coarse to moderately fine textured, permeable soils of the alluvial fans and flood plains.
  - Unit IIw–3.—Imperfectly drained, moderately deep to deep, moderately coarse textured soils of the alluvial fans and flood plains.
- Subclass IIs.—Soils that have moderate limitations because of depth, low water-holding capacity, or salts and alkali.
  - Unit IIs–3.—Deep, well drained to moderately well drained, moderately coarse to moderately fine textured soils of the alluvial fans.
  - Units IIs–6.—Slightly saline-alkali, very deep, moderately coarse to medium textured, moderately well drained soils of the alluvial fans and flood plains.
  - Unit IIs–7.—Moderately slowly to slowly permeable, very deep, well-drained, moderately coarse to moderately fine textured soils of the low terraces.

Class III.—Soils that have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.
- Subclass IIIe.—Soils that are subject to severe erosion if they are tilled and not protected.
  - Unit IIIe–1.—Gently sloping to sloping, moderately deep, moderately coarse to medium textured, moderately permeable soils of the older terraces.
  - Unit IIIe–4.—Coarse-textured, moderately deep to very deep, well to excessively drained, very rapidly permeable soils of the flood plains and wind-modified alluvial fans.
- Subclass IIIw.—Soils that are severely limited by excess water.
  - Unit IIIw–3.—Poorly drained, moderately deep to very deep, moderately coarse to medium textured soils of alluvial fans and flood plains.
  - Unit IIIw–4.—Imperfectly to poorly drained, coarse-textured, moderately deep soils of the wind-modified alluvial fans.
  - Unit IIIw–5.—Imperfectly and poorly drained, fine-textured, slowly and very slowly permeable soils of the basins and old terraces.
  - Unit IIIw–6.—Imperfectly to very poorly drained, slightly to moderately saline or saline-alkali, very deep, slowly to moderately rapidly permeable soils of the basins.
- Subclass IIIs.—Soils severely limited by restricted depth, low moisture-holding capacity, fine-texture, salt and alkali, or a combination of these.

Unit IIIs-3.—Moderately deep, well-drained, moderately coarse to moderately fine textured soils of the alluvial fans.

Unit IIIs-4.—Moderately coarse textured, very deep, moderately rapidly to very rapidly permeable soils of the recent alluvial fans and flood plains.

Unit IIIs-5.—Fine-textured, well-drained, slowly to very slowly permeable soils of the terraces and low foothills.

Unit IIIs-6.—Moderately saline-alkali, moderately well drained, very deep, moderately coarse textured soils of the alluvial fans and flood plains.

Unit IIIs-8.—Shallow, slightly saline-alkali, moderately coarse textured, moderately deep soils of the basins and low terraces.

Class IV.—Soils with very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe.—Soils very severely limited by risk of erosion if not protected.

Unit IVe-1.—Rolling, moderately deep, medium or moderately coarse textured, moderately permeable soils of the older terraces.

Unit IVe-3.—Shallow, moderately slowly to very slowly permeable, moderately coarse to medium textured soils of older alluvial fans and terraces.

Unit IVe-4.—Coarse-textured, excessively drained, very deep, very rapidly permeable soils of the flood plains and wind-modified fans.

Unit IVe-5.—Fine-textured, sloping to hilly, well-drained, shallow to moderately deep soils of the uplands.

Subclass IVw.—Soils very severely limited by excess water.

Unit IVw-4.—Imperfectly to very poorly drained, moderately deep to very deep soils of the wind modified alluvial fans.

Unit IVw-6.—Poorly drained, moderately saline alkali, moderately fine textured, shallow to moderately deep soils of the basins.

Subclass IVs.—Soils very severely limited by salts and alkali, restricted soil depth, or both.

Unit IVs-3.—Shallow, moderately coarse to moderately fine textured, well-drained soils of the terraces and uplands.

Unit IVs-6.—Strongly saline-alkali, moderately coarse textured, well-drained soils of the basins.

Unit IVs-8.—Shallow, moderately saline-alkali, moderately coarse textured, very slowly permeable soils of the basins and low terraces.

Class V.—Soils not likely to erode that have other limitations, impractical to remove, without major reclamation, that limit their use largely to pasture, or range, woodland, or wildlife food and cover. (There are no Class V soils in the Eastern Stanislaus Area.)

Class VI.—Soils with severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe.—Soils severely limited by hazard of erosion.

Unit VIe-3.—Shallow, moderately coarse to fine textured, moderately to slowly permeable, rolling to hilly soils of the foothills and dissected terraces.

Unit VIe-4.—Moderately deep, moderately coarse textured soils of the rolling foothills.

Unit VIe-9.—Shallow, moderately coarse to medium textured, slowly to very slowly permeable, rolling to hilly soils of the dissected terraces.

Subclass VIw.—Soils severely limited by excess water.

Unit VIw-6.—Poorly drained, moderately to strongly saline-alkali, very slowly permeable soils of the basins.

Subclass VIs.—Soils unsuited to cultivation because of restricted depth and salts and alkali.

Unit VIs-8.—Shallow, strongly saline-alkali, moderately coarse textured soils of the low terraces and basins.

Class VII.—Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited by risk of erosion if not protected.

Unit VIIe-3.—Very shallow to shallow, rolling to steep soils of the uplands and dissected terraces.

Unit VIIe-9.—Shallow to very shallow, undulating to steep, well to somewhat excessively drained, moderately coarse and medium textured soils of the uplands and dissected old alluvial fans.

Class VIII.—Soils and land types with limitations that preclude their use, without major reclamation, for commercial plants and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Subclass VIIIs.—Land types, mostly rock or rock fragments.

Unit VIIIs-1.—Nonagricultural miscellaneous land types.

Discussions of management for each of the capability units in the Eastern Stanislaus Area follow.

Capability unit I-1

In this unit are very deep, moderately coarse to moderately fine textured, permeable, nearly level, well-drained soils of the recent alluvial fans and flood plains. These are the best agricultural soils in the Area and present few limitations to use and management. They are sandy loams to clay loams, more than 4 feet deep. The Hanford soils, deep over silt, are not so permeable as the other soils, but the silt is penetrated by roots and moisture.

The soils in this unit are—

(GrA)	Greenfield fine sandy loam, 0 to 3 percent slopes.
(GsA)	Greenfield sandy loam, 0 to 3 percent slopes.
(HbA)	Hanford fine sandy loam, 0 to 3 percent slopes.
(HcA)	Hanford sandy loam, 0 to 3 percent slopes.
(HbpA)	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes.
(HbsA)	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes.

(HdsA) Hanford, sandy loam, deep over silt, 0 to 1 percent slopes.
(HeA) Hanford very fine sandy loam, 0 to 1 percent slopes.
(HoA) Honcut fine sandy loam, 0 to 1 percent slopes.
(HpA) Honcut, loam, 0 to 1 percent slopes.
(HrA) Honcut sandy loam, 0 to 1 percent slopes.
(HnA) Honcut clay loam, 0 to 1 percent slopes.
(OaA) Oakdale sandy loam, 0 to 3 percent slopes.
(WtA) Wyman clay loam, 0 to 1 percent slopes.
(WvA) Wyman loam, 0 to 1 percent slopes.

Use and management.—These soils are suitable for all crops that are adapted to the climate and that require good drainage. These crops include row and field crops, deciduous fruits and nuts, grapes, and pasture.

These soils are comparatively high in mineral nutrients, but both the organic-matter content and nitrogen content are low. Nonleguminous plants will respond to nitrogen, and legumes will benefit in quality, if not in yields, from phosphorus and probably sulfur. Potash is generally adequate for most crops; but potatoes, and perhaps other specialty crops, respond to potash at the higher levels of management. Generally no minor elements are known to be deficient, but in some places there is evidence of zinc and manganese deficiency, especially for almonds and peaches.

The use of green-manure crops, crop rotations, and crop residues helps maintain organic-matter content and good structure. Excessive irrigation causes water loss and leaching of the soils and should be avoided. Excessive cultivation, and cultivation when the soils are wet, can cause plowsole formation and reduced infiltration of water.

These soils require little leveling. Where needed, however, leveling can be done with few or no lasting injurious effects.

If the soils are reasonably well managed, erosion is not a problem. If improperly handled, however, some of the coarser textured soils are susceptible to blowing.

Capability unit IIe-1

The soils in this unit are very deep, moderately coarse textured, well drained, and gently sloping. They are on the alluvial fans and flood plains. These soils are similar to those in capability unit I-1, except that they have moderate limitations because of slope and risk of erosion.

The soils in this unit are—

(GsB) Greenfield sandy loam, 3 to 8 percent slopes.
(HdB) Hanford sandy loam, 3 to 8 percent slopes.
(SnB) Snelling sandy loam, 3 to 8 percent slopes.

Use and management. These soils are suitable for row and field crops, deciduous fruits and nuts, grapes, and pasture.

The irrigation of slopes and the hazard of erosion cause minor management problems. Cross-slope farming, crop mulches, and cover crops control sheet erosion. Irrigation water should be carefully applied, generally by contour or sprinkler irrigation. If these methods are used, water has more time to enter the soils and erosion and runoff are reduced. Deep cuts may be made in leveling or in smoothing irregularities in slope without lasting injurious effects.

Use of fertilizer and practices for the maintenance of productivity and organic matter are the same as for the soils in capability unit I-1.

Capability unit IIw-2

In this unit are imperfectly to poorly drained, very deep, moderately coarse to moderately fine textured, permeable soils of the alluvial fans and flood plains. These soils have moderate limitations because of wetness. The water table fluctuates, but it is within 5 feet of the surface part of the year. The soils of this unit are nearly level sandy loams to silty clay loams, more than 5 feet deep. Some of these soils have a slight saline or saline-alkali problem.

The soils in this unit are—

(CcA) Columbia fine sandy loam, 0 to 1 percent slopes.
(CeA) Columbia loam, 0 to 1 percent slopes.
(CfA) Columbia silt loam, 0 to 1 percent slopes.
(CgA) Columbia silt loam, slightly saline, 0 to 1 percent slopes.
(CkA) Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes.
(CmA) Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes.
(CoA) Columbia silty clay loam, slightly saline, 0 to 1 percent slopes.
(CpA) Columbia soils, 0 to 1 percent slopes.
(GfA) Grangeville fine sandy loam, 0 to 1 percent slopes.
(GgA) Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(GhA) Grangeville sandy loam, 0 to 1 percent slopes.
(GkA) Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(GmA) Grangeville very fine sandy loam, 0 to 1 percent slopes.
(GnA) Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(HddA) Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes.
(TgA) Temple silty clay loam, 0 to 1 percent slopes.
(ThA) Temple silty clay loam, slightly saline, 0 to 1 percent slopes.
(TbA) Temple loam, overwashed, 0 to 1 percent slopes.
(TcA) Temple loam, overwashed, slightly saline, 0 to 1 percent slopes.

Use and management.—These soils are suitable for row and field crops, grain, and pasture. Orchards are not well suited to these soils, and alfalfa may be unfavorably affected.

The water table may be controlled by use of deep, open or tile drains. Irrigation water should be applied carefully to prevent the occurrence of a perched water table and waterlogging. Provisions should be made for the disposal of excess surface water.

The soils are moderately high to high in natural fertility. The supplies of organic matter and nitrogen are somewhat greater than for the soils of capability unit I-1. Nonleguminous crops will respond to nitrogen. Phosphorus, and possibly sulfur, will improve the quality if not the yields of legumes. Potash generally is not needed for most crops, but it may benefit potatoes or other specialty crops. Use of green-manure crops, crop residues, and crop rotations will help maintain the supply of organic matter and good structure.

Capability unit IIw-3

This capability unit consists of imperfectly drained, moderately deep to deep, moderately coarse textured soils of the alluvial fans and flood plains. These soils have moderate limitations because of wetness and restricted depth. They consist of more recent alluvial fan material over finer textured, more slowly permeable material. The

overlying material varies in thickness, which ranges from about 24 to 60 inches and averages from 30 to 40 inches in most places. This material is more coarsely textured, is more rapidly permeable, and has a lower water-holding capacity than the material of the underlying substratum. The underlying material is composed of stratified silt and very fine sand that may be weakly cemented with lime. Some of the soils in this unit have a slight saline-alkali problem.

The soils in this unit are—

(DmA)	Dinuba fine sandy loam, 0 to 1 percent slopes.
(DoA)	Dinuba fine sandy loam, deep, 0 to 1 percent slopes.
(DpA)	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(DtA)	Dinuba sandy loam, deep, 0 to 1 percent slopes.
(DrA)	Dinuba sandy loam, 0 to 1 percent slopes.
(DwA)	Dinuba sandy loam, slightly saline alkali, 0 to 1 percent slopes.

Use and management.—Crops adapted to the climate do well on these soils. The range of use, however, is restricted by the depth of the soil and the risk of a perched water table and waterlogging. Row crops, grain, and irrigated pasture are suitable. The longer lived, deeper rooted deciduous fruit and nut crops are generally not well suited. Alfalfa may be unfavorably affected.

These soils are not suited to subsurface drainage, because of the slowly permeable underlying material. Irrigation water should be applied carefully to prevent a temporarily high or perched water table. Frequent, light amounts of water are advisable. Provisions should be made for the disposal of excess surface water.

The soils are low to moderately high in mineral fertility. The supplies of organic matter and nitrogen, however, are low. Nonleguminous crops will respond to nitrogen. Legumes benefit from phosphorus and possibly sulfur. Potash generally is not needed for most crops, but it may benefit potatoes or other specialty crops. The supply of organic matter and the soil structure may be maintained by use of green-manure crops, crop rotations, and crop residues. The soils that are slightly saline-alkali should be treated with gypsum; careful leaching should follow.

These soils do not require much leveling. Where needed, however, leveling generally can be done without lasting injurious effects.

Capability unit IIs–3

This unit is made up of deep, well drained to moderately well drained, moderately coarse to moderately fine textured soils of the alluvial fans. Use of these soils is moderately limited by their restricted depth. These soils are similar to those in capability unit I–1, but are underlain at 36 to 60 inches by an unrelated hardpan or semiconsolidated substratum. They range in texture from sandy loam to clay loam. Permeability is moderate to moderately slow down to the hardpan or substratum; then it is very slow. Slopes are very gentle, and the erosion hazard is slight.

The soils in this unit are—

(BcA)	Bear Creek clay loam, 0 to 3 percent slopes.
(BgA)	Bear Creek gravelly loam, 0 to 3 percent slopes.
(BmA)	Bear Creek loam, 0 to 3 percent slopes.
(GvA)	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes.
(HdpA)	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes.

Use and management.—Except for deep-rooted orchard crops, the same crops are suitable for the soils of this unit as for those of capability unit I–1. The soils of this unit require similar but more careful management. Because of the slow permeability in the hardpan and substratum, careful use of irrigation water is essential to prevent waterlogging and the formation of a perched water table. Frequent and light applications of water are advisable.

Excessive leveling is generally not needed. Moderate cuts can be made without harmful effects. Erosion is not a problem, but some of the coarser textured soils can be damaged by wind if they are improperly handled. Other management practices, including use of fertilizer and the maintenance of organic matter and structure, are the same as for capability unit I–1.

Capability unit IIs–6

This unit consists of slightly saline-alkali, very deep, moderately coarse to medium textured, moderately well drained soils of the alluvial fans and flood plains. Because these soils are slightly saline-alkali, they have moderate limitations. The salts and alkali are throughout the subsoil and affect up to 20 percent of the surface soil. The surface soil ranges in texture from sandy loam to clay loam. These soils have very gentle slopes. Runoff is very slow. Internal drainage is moderately slow to very slow. The erosion hazard is slight.

The soils in this unit are—

(CbA)	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes.
(MnA)	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes.
(MpA)	Modesto loam, slightly saline alkali, 0 to 1 percent slopes.
(TmA)	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(TpA)	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes.

Use and management.—These soils are suitable for crops that are tolerant of slightly saline-alkali conditions. Grapes, fruits, nuts, beans, and other less tolerant crops are poorly suited. These crops grow unevenly on these soils, are short lived, and are less productive.

Practices for reclamation of saline-alkali areas should be used on these soils. Application of organic matter and gypsum, along with leaching, should improve the surface soil. The reduction of salts and alkali in the subsoil is more difficult, and improvement will be more gradual.

Proper irrigation and tail-water disposal are important. The soils should be carefully leveled, and surface drainage should be provided. Gypsum should be applied before planting the crop. Except for periodic deep leaching, frequent light irrigations are most suitable for improving these soils.

Mineral fertility is low. Nonlegumes will respond to nitrogen, and legumes will respond to phosphate and possibly sulfur. The use of green-manure crops, crop rotations, crop residue, and manure helps maintain organic-matter content and good structure.

Capability unit IIs–7

This unit consists of moderately slowly to slowly permeable, very deep, well-drained, moderately coarse to moderately fine textured soils of the low terraces. These

soils have moderate limitations because of the moderately slow to slow permeability of the subsoil. They are on gently sloping, older alluvial fans and terraces. Runoff is good, but the subsoil has slow drainage because it is clayey. There is a slight erosion hazard.

The soils in this unit are—

(CaA)	Chualar sandy loam, 0 to 3 percent slopes.
(MmA)	Modesto clay loam, 0 to 1 percent slopes.
(MoA)	Modesto loam, 0 to 1 percent slopes.
(RvA)	Ryer clay loam, 0 to 1 percent slopes.
(RyA)	Ryer loam, 0 to 1 percent slopes.
(SnA)	Snelling sandy loam, 0 to 3 percent slopes.

Use and management.—Because of the clayey subsoil, these soils are best suited to grain, row and field crops, pasture, and other shallow-rooted crops.

The soils of this unit are lower in organic matter, nitrogen, and mineral fertility than the soils in capability unit I–1. Irrigated crops other than legumes respond to nitrogen, and legumes respond to phosphorus and sulfur. Dry-farmed grain responds to nitrogen and phosphorus. Range plants produce the best yields where nitrogen and phosphate fertilizers are applied. Legumes are possibly benefited by sulfur. Potash is generally adequate, but specialty crops, such as potatoes, are likely to respond to potash at the highest levels of management. Use of green-manure crops, crop rotations, and crop residues helps maintain organic matter and soil structure.

Irrigation water should be applied carefully to prevent waterlogging and a perched water table. Excessive cultivation, particularly when the soils are wet, causes the formation of a plowsole and water infiltration problems.

These soils do not require much leveling. Where needed, however, leveling can be done with few or no lasting injurious effects.

Capability unit IIIe–1

In this unit are gently sloping to sloping, moderately deep, moderately coarse to medium textured, moderately permeable soils of the older terraces. These soils are on the more sloping and dissected, weakly consolidated terrace deposits. The erosion hazard caused by slope severely limits their use. These soils are well drained and have moderate to moderately slow permeability.

The soils in this unit are—

(PmB)	Pentz loam, moderately deep, 3 to 8 percent slopes.
(WmB)	Whitney sandy loams, 3 to 8 percent slopes.
(WrA)	Whitney and Rocklin sandy loams, 0 to 3 percent slopes.
(WrB)	Whitney and Rocklin sandy loams, 3 to 8 percent slopes.

Use and management.—These soils are suitable for irrigated grain, for row and field crops, for pasture, and possibly for grapes. They are not suited to deep-rooted deciduous fruit and nut crops. At present they are principally used for dry-farmed grain and range. If irrigation water is available, these soils are suited to all crops that require a moderate rooting depth.

The soils in this unit should be in permanent cover 50 percent of the time. If they are cultivated continuously, they should be protected from erosion by use of cross-slope cultivation, cover crops, and crop residues. Irrigation water should be applied carefully, either by sprinkler or contour irrigation, to avoid erosion and to conserve moisture.

Mineral fertility is moderate to low, and the organic-matter content and nitrogen content are low. Dry-farmed grain and range respond to nitrogen and phosphorus. Legumes benefit from sulfur. Irrigated crops other than legumes respond to nitrogen, and legumes respond to phosphorus and sulfur. Green-manure crops, crop rotations, and crop residues help maintain organic matter and soil structure.

If used for range, these soils should be managed like the soils in capability unit VIe–4.

Capability unit IIIe–4

In this unit are coarse-textured, moderately deep to very deep, well to excessively drained, very rapidly permeable soils of the flood plains and wind-modified alluvial fans. These soils are severely limited because they are coarse textured and subject to erosion. They are droughty and moderate to low in mineral fertility. Some of the soils are underlain by a silty substratum or by clay.

Columbia soils, channeled, 6 to 8 percent slopes, are included in this group because of slope, texture, and erosion hazard. They are imperfectly drained. When leveled, they are included in capability unit IIw–2. The soils in this unit are—

(CsB)	Columbia soils, channeled, 0 to 8 percent slopes.
(DeA)	Delhi loamy sand, 0 to 3 percent slopes.
(DeB)	Delhi loamy sand, 3 to 8 percent slopes.
(DfA)	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes.
(DgA)	Delhi loamy sand, silty substratum, 0 to 3 percent slopes.
(TuA)	Tujunga loamy sand, 0 to 3 percent slopes.
(TuB)	Tujunga loamy sand, 3 to 5 percent slopes.

Use and management.—Except for the Delhi soils, which are underlain by clay, and the Columbia soils, which are subject to overflow, these soils are suitable for orchards, vineyards, alfalfa, and row and field crops.

Wind erosion is a severe hazard on exposed or improperly managed soils. Cover crops and crop residues used as a mulch help to reduce the hazard. Water erosion is a hazard on irrigated soils that have slopes of 3 to 8 percent. It can be controlled by irrigation with sprinklers or by using low heads and short runs with furrows or borders. Irrigation by one of these methods will also reduce water loss and the leaching of plant nutrients.

These soils are low in mineral fertility. They are especially low in organic matter and nitrogen. Minor elements many crops need are lacking. Nonlegumes respond to nitrogen, and legumes to phosphorus and sulfur. Specialty crops, such as potatoes, respond to potash at the higher levels of management. Split applications of fertilizer give the best results. Of the minor elements, zinc is deficient for grapes, deciduous fruits, and nuts. There may also be deficiencies in manganese and other minor elements. The supply of organic matter may be maintained by using manure, green-manure crops, crop rotations, and crop residues.

Leveling ordinarily eliminates much of the difference in slope. Deep cuts may be made without lasting injurious effects, except for those soils underlain by a silty substratum or by clay.

If sprinkler irrigation is used, deep leaching can be controlled. This method will therefore best conserve moisture and nutrients.

A number of areas of these soils occur as long, narrow stringers through areas of finer textured soils. If possible, fields should be arranged so that these droughty soils may be irrigated separately, preferably by sprinkler.

Capability unit IIIw-3

In this unit are poorly drained, moderately deep to very deep, moderately coarse to medium textured soils of alluvial fans and flood plains. These soils are severely limited by wetness and restricted depth. They have a clayey subsoil or are underlain by silt or a hardpan. They are on low-lying areas that remain wet for long periods. The poor drainage is caused partly by a high water table and partly by the slowly permeable subsoil or substratum. The Columbia soil is slightly saline-alkali.

The soils in this unit are—

(ChA) Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes.
(DuA) Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes.
(MvA) Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes.
(SwA) Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes.

Use and management.—These soils are suitable for row crops, grain, and pasture. Orchard crops and other deep-rooted crops are not suitable.

Surface drainage is needed to handle surplus water. These soils are not suitable for deep drainage because they have a slowly permeable subsoil or substratum.

Leveling should be done with care. Shallow cuts may reduce the effective rooting depth, and deeper cuts may expose the clayey subsoil, silt, or hardpan.

Other management practices for these soils are the same as those outlined for the soils in capability unit IIw-2.

Capability unit IIIw-4

This unit consists of imperfectly to poorly drained, coarse-textured, moderately deep soils of the wind modified alluvial fans. These soils are severely limited by poor drainage, restricted depth, and coarse texture. They are in depressions and low-lying areas that are affected by a fluctuating high water table much of the year. The surface soils are sand and loamy sand; they are underlain by an unrelated silty substratum, which makes drainage difficult. When the surface soils dry, they are subject to severe wind erosion if left without cover. One soil in this unit is slightly saline alkali.

The soils in this unit are—

(HfA) Hilmar loamy sand, 0 to 1 percent slopes.
(HfdA) Hilmar loamy sand, deep, 0 to 1 percent slopes.
(HkbA) Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes.
(HmA) Hilmar sand, 0 to 3 percent slopes.

Use and management.—These soils are suitable for pasture, grain, and row crops. Deep-rooted crops, such as orchard crops and alfalfa, are not suitable.

Drainage can be improved by lowering the water table with drainage pumps. Irrigation water should be applied carefully to avoid raising the water table. Excess water should be removed by surface drainage. Areas that are slightly saline-alkali should be treated with gypsum and leached after drainage has been established.

The depressions are often filled with material from higher areas by leveling. These depressions should be cleared of grass, reeds, and tules before leveling.

Other management practices for these soils are the same as those for the soils in capability unit IIIe-4.

Capability unit IIIw-5

This unit consists of imperfectly and poorly drained, fine-textured, slowly and very slowly permeable soils of the basins and old terraces. Imperfect and poor drainage and fine texture generally limit the use of these soils. The Paulsell, Meikle, and Alamo soils are in basins or depressions in the older fans and terraces. The Meikle and Alamo soils are without normal external drainage, but the Paulsell soil is usually cut by deep, incised drainageways. The Alamo soil is shallow to hardpan, but it is included in this unit because it is the only soil of its kind. The Temple soils are in the basin areas in association with other poorly drained soils.

The soils of this unit have silty clay and clay textures and are slowly permeable. Runoff is very slow; some areas are ponded. Internal drainage is very slow to slow, and there is a high water table part of the year. Some areas are slightly to moderately saline.

The soils in this unit are—

(AcA) Alamo clay, 0 to 1 percent slopes.
(MkA) Meikle clay, 0 to 1 percent slopes.
(PaA) Paulsell clay, 0 to 1 percent slopes.
(TeA) Temple silty clay, slightly saline, 0 to 1 percent slopes.
(TfA) Temple silty clay, moderately saline, 0 to 1 percent slopes.

Use and management.—These soils are suitable for grain, pasture, and shallow-rooted row and field crops. Because of their extent and position, the Alamo, Meikle, and Paulsell soils are used in the same way as the better drained surrounding soils.

The Alamo and Meikle soils are difficult to drain because of their position. Long after the surrounding soils have drained, they are too wet to cultivate. Drainage should be provided if adequate outlets can be found. Drainage that keeps the high water table at a more constant level can be used on the Temple and Paulsell soils.

Irrigation water should be applied carefully to avoid ponding or waterlogging. Surplus water should be removed by surface drainage. The mineral fertility of these soils is moderate to low. Grain, pasture, and range respond to nitrogen and phosphorus. Row crops respond to nitrogen. Legumes benefit from sulfur. Organic matter can be maintained by use of green-manure crops, crop rotation, and crop residues.

When drainage has been established, the soils with slight and moderate salinity may be reclaimed by leaching.

As the Alamo and Meikle soils are in depressions, they are often filled when the associated better drained soils are leveled. When they are thus filled, their need for drainage is often eliminated.

Capability unit IIIw-6

This unit is made up of imperfectly to very poorly drained, slightly to moderately saline or saline-alkali, very deep, slowly to moderately rapidly permeable soils of the basins. These soils are severely limited because they are saline or saline-alkali and are poorly drained.

They are sandy loams to silty clay loams that have a water table that is near the surface for long periods. Intensive reclamation and drainage practices are needed if cultivated crops are to be grown.

The soils in this unit are –

(CdA)	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes.
(DzA)	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes.
(FoA)	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes.
(GoA)	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(TkA)	Temple silty clay loam, moderately saline, 0 to 1 percent slopes.
(TdA and CnA)	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes.

Use and management.—The soils of this unit are suitable for irrigated pasture and grain, and for row crops that tolerate moderately saline or saline-alkali conditions.

These soils can be feasibly drained by open or tile drains. When drainage is established, the saline soils may be reclaimed by leaching with excess water. The saline-alkali soils should have heavy applications of gypsum, followed by leaching with excess water. A temporary high water table can be avoided by careful leaching.

Irrigation water should be carefully applied so as to avoid raising the water table. Adequate surface drainage should be provided for removal of excess surface water.

Natural fertility is low. Legumes respond to phosphorus, and possibly to sulfur. Nonlegumes respond to nitrogen. Potash is generally adequate for most crops, but some specialty crops may respond to potash at the highest level of management. The use of crop rotations, crop residues, and green-manure crops helps maintain organic matter and good structure.

Capability unit IIIs-3

This unit consists of moderately deep, well-drained, moderately coarse to moderately fine textured soils of the alluvial fans. These soils are severely limited by limited depth. They are typically 20 to 36 inches deep to bedrock, semiconsolidated material, or gravel. They range in texture from sandy loam to clay loam. Permeability is moderate to slow; the underlying bedrock or semiconsolidated material is nearly impermeable. The Wyman soil, underlain by gravel, is included in this unit, as it is the only soil of its kind mapped in the Area. Permeability in the gravelly substratum of the Wyman soil is very rapid.

The soils in this unit are similar to those in capability unit IIs-3, except that they are shallower.

The soils in this unit are—

(HtA)	Hopeton clay loam, 0 to 3 percent slopes.
(HuA)	Hopeton loam, 0 to 3 percent slopes.
(MtA)	Montpellier coarse sandy loam, 0 to 3 percent slopes.
(ReA)	Rocklin sandy loam, 0 to 3 percent slopes.
(WyA)	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes.

Use and management.—These soils are suitable for grain, vineyards, irrigated pasture, and shallow-rooted row, field, and specialty crops.

Care must be used in irrigating these soils because of their restricted depth. Frequent, light irrigations are necessary to avoid temporary waterlogging, formation of a perched water table, and reduced aeration. Adequate surface drainage should be provided.

Natural fertility of these soils is low to moderate. Nonlegumes respond to nitrogen. Legumes respond to phosphorus, and possibly to sulfur. Potash is adequate for most crops. Some specialty crops, such as potatoes, may respond to potash at high levels of management. The use of crop rotations, green-manure crops, and crop residues helps maintain organic matter and good structure.

Leveling must be done with care. Shallow cuts reduce the effective rooting depth, and deeper cuts expose the hardpan.

Capability unit IIIs-4

In this unit are moderately coarse textured, very deep, moderately rapidly to very rapidly permeable soils of the recent alluvial fans and flood plains. These soils are severely limited by low moisture-holding capacity. They are droughty because of gravel or underlying sand. Except for Anderson gravelly fine sandy loam, 3 to 8 percent slopes, the soils in this unit have gentle slopes.

The soils in this unit are—

(AnA)	Anderson gravelly fine sandy loam, 0 to 3 percent slopes.
(AnB)	Anderson gravelly fine sandy loam, 3 to 8 percent slopes.
(AoA)	Anderson gravelly fine sandy loam, channeled, 0 to 3 percents slopes.
(HbmA)	Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes.
(HcA)	Hanford gravelly sandy loam, 0 to 3 percent slopes.
(HdmA)	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes.

Use and management.—These soils are suitable for most crops adapted to the climate. Rice and edible root crops are not suited to the gravelly soils.

Because of their low moisture-holding capacity, these soils must be carefully irrigated. Irrigation runs should be short, and frequent, light applications of irrigation water should be used. Such applications prevent water loss and leaching of plant nutrients. The Anderson gravelly fine sandy loam, 3 to 8 percent slopes, should be irrigated with sprinklers.

Natural fertility is low to moderate. Nonlegumes respond to nitrogen. Legumes respond to phosphate fertilizers and to sulfur. Split applications of nitrogen fertilizer are best because of the rapid leaching. The use of crop rotations, green manure crops, and crop residues helps maintain organic matter and good structure.

Capability unit IIIs-5

This unit is made up of fine-textured, well-drained, slowly to very slowly permeable soils of the terraces and low foothills. These soils are severely limited by their fine texture. They have a clay texture, and they rest on bedrock or soft sediments. Slopes are gentle, drainage is good, and the erosion hazard is slight.

The soils in this unit are—

(HsB)	Hopeton clay, 3 to 8 percent slopes.
(PtB)	Peters clay, 0 to 8 percent slopes.
(PvB)	Peters cobbly clay, 0 to 8 percent slopes.
(RaA)	Raynor clay, 0 to 3 percent slopes.
(RaB)	Raynor clay, 3 to 8 percent slopes.
(RbB)	Raynor cobbly clay, 0 to 8 percent slopes.
(RtA)	Ryer clay, 0 to 1 percent slopes.
(ZaB)	Zaca clay, 3 to 8 percent slopes.

Use and management.—These soils are suitable for grain, pasture, and row and field crops. They are not suited to orchard crops, alfalfa, and other deep rooted crops. Before the cobbly Peters and Raynor soils can be cultivated, the cobbles must be removed because of the fine texture and restricted depth.

Irrigation water should be applied carefully to prevent waterlogging and a perched water table. Adequate surface drainage should be provided to remove excess water. Sprinklers are best for irrigating areas that have slopes of 1 to 8 percent.

Natural fertility is moderate to high. Legumes respond to phosphorus, and possibly to sulfur. Nonlegumes respond to nitrogen. Dry-farmed grain responds to nitrogen and phosphorus. The use of green-manure crops, crop rotations, and crop residues helps maintain organic matter and soil structure.

Cuts made when these soils are leveled should be shallow because of the restricted depth of soil material.

Capability unit IIIs–6

In this unit are moderately saline-alkali, moderately well drained, very deep, moderately coarse textured soils of the alluvial fans and flood plains. These soils have severe limitations because they are moderately saline-alkali. All of the subsoil and 20 to 70 percent of the surface soil are saline-alkali. The soils of this capability unit are similar to those of capability unit IIs 6, but they contain larger amounts of salts and alkali.

The soils in this unit are—

(TrA) Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(TnA) Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.

Use and management. These soils are best suited to crops that can tolerate moderately saline-alkali conditions. These include grain, row and field crops, and irrigated pasture. Deep-rooted crops, such as trees, are not suited.

Reclamation measures are similar to those discussed for the soils of capability unit IIs–6, but larger amounts of water and gypsum are needed. More time is also needed for improvement.

Other important management requirements, such as the use of fertilizer, leveling, and irrigation, are similar to those of the soils in capability unit IIs–6.

Capability unit IIIs–8

This unit consists of shallow, slightly saline-alkali, moderately coarse textured, moderately deep soils of the basins and low terraces. These soils are severely limited because they are shallow and slightly saline-alkali. They are in nearly level areas. They range in texture from sandy loam to fine sandy loam and are 20 to 36 inches deep over a hardpan or claypan. Salts and alkali occur throughout the subsoil and affect up to 20 percent of the surface soil. Because there is a hardpan or claypan at moderate depths, reclamation of these soils is difficult.

The soils in this unit are -

(FpA) Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(FtA) Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(FwA) Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes.
(WaA) Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.
(WdA) Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes.

Use and management.—The soils of this unit are suitable for shallow-rooted crops that can tolerate slight amounts of salts and alkali. These include such crops as row, field, and specialty crops, grain, and irrigated pasture. Deep-rooted crops, such as orchard crops and alfalfa, are not suited.

Gypsum, together with water, should be used to move the excess salts and alkali as deeply into the subsoil as possible.

Because of their restricted depth, these soils must be irrigated carefully. Frequent, light, applications of irrigation water are desirable to prevent waterlogging, formation of a perched water table, and reduced aeration. Provisions should be made for disposal of excess water.

Natural fertility is low. Legumes respond to phosphorus, and possibly to sulfur. Nonlegumes respond to nitrogen, and some specialty crops may respond to potash. Green-manure crops, crop residues, and crop rotations help maintain organic matter and soil structure.

Leveling should be done carefully, as relatively shallow cuts reduce the effective rooting depth, and deeper cuts expose the hardpan.

Capability unit IVe–1

This unit consists of rolling, moderately deep, medium or moderately coarse textured, moderately permeable soils of the older terraces. These soils are suited to limited cultivation; but because of slope and moderate soil depth, the risk of erosion is severe in areas left without ground cover. The soils are sandy loams or loams underlain by weakly consolidated terrace deposits at less than 3 feet. They are well drained and have moderate to moderately rapid permeability. The Hanford soil is very deep but is included in this unit because it is the only soil of its kind mapped in the area.

The soils in this unit are—

(HdC) Hanford sandy loam, 8 to 15 percent slopes.
(PmC) Pentz loam, moderately deep, 8 to 15 percent slopes.
(PmC2) Pentz loam, moderately deep, 8 to 15 percent slopes, eroded.
(WmC) Whitney sandy loams, 8 to 15 percent slopes.
(WmC2) Whitney sandy loams, 8 to 15 percent slopes, eroded.
(WrC) Whitney and Rocklin sandy loams, 8 to 15 percent slopes.

Use and management.—These soils are suitable for dry-farmed grain, irrigated pasture, field crops, and range. They should be under permanent cover 3 out of 4 years.

Other management requirements are similar to those of the soils in capability unit IIIe–1. When used for range, however, these soils require the same management as the soils in capability unit VIe–4.

Capability unit IVe–3

In this unit are shallow, moderately slowly to very slowly permeable, moderately coarse to medium textured soils of older alluvial fans and terraces. These soils are suited to cultivation; but because of slope and shallow depth, the risk of erosion is severe. The depth to claypan, bedrock, or semiconsolidated material is 10 to 20 inches. Texture ranges from sandy loam to clay loam; some of the soils are gravelly. Permeability is moderately slow to

very slow, and the underlying restricting layers are practically impermeable. Runoff is slow to medium. The erosion hazard is moderate to high if the soils are left without protective cover. The fans and terraces on which these soils occur are dissected.

The soils in this unit are—

(AuB)	Auburn clay loam, 3 to 8 percent slopes.
(BeA)	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes.
(CyB)	Corning gravelly sandy loam, 3 to 8 percent slopes.
(CyC)	Corning gravelly sandy loam, 8 to 15 percent slopes.
(HtB)	Hopeton clay loam, 3 to 8 percent slopes.
(HuB)	Hopeton loam, 3 to 8 percent slopes.
(KgB)	Keyes gravelly clay loam, 0 to 8 percent slopes.
(MdB)	Madera sandy loam, 2 to 4 percent slopes.
(MtB)	Montpellier coarse sandy loam, 3 to 8 percent slopes.
(MtC)	Montpellier coarse sandy loam, 8 to 15 percent slopes.
(RdB)	Redding gravelly loam, 0 to 8 percent slopes.
(ReB)	Rocklin sandy loam, 3 to 8 percent slopes.
(SaB)	San Joaquin sandy loams, 3 to 8 percent slopes.

Use and management.—The soils in this unit are suitable for dry-farmed grain, irrigated pasture, field crops, and range.

Measures to control erosion are necessary because of the slope and restricted depth. When these soils are cultivated, cross-slope farming and stubble mulching should be used for protection.

Because the soils are shallow, they should be leveled with minimum soil movement.

When irrigated, these soils require careful practices that prevent erosion and water loss. Because of the low water-holding capacity, they should be given frequent, light applications of irrigation water. Sprinkler irrigation is best suited.

The soils are naturally low to moderate in fertility, especially in supply of nitrogen, phosphorus, and lime. Dry-farmed grain responds to nitrogen and phosphorus. Dryland range and irrigated pasture respond to nitrogen, phosphorus, and sulfur. Lime, and possibly potash, help produce maximum yields. The use of crop rotations and crop residues helps to maintain organic matter and soil structure.

When the soils are used as range, they require the same management practices as the soils of capability units VIe–3 and VIe–9.

Capability unit IVe–4

This unit consists of coarse-textured, excessively drained, very deep, very rapidly permeable soils of the flood plains and wind-modified fans. These soils are severely limited because of coarse texture and a high hazard of wind erosion. They are similar to the soils of capability unit IIIe–4 but are coarser textured, more droughty, and lower in fertility. Control of wind erosion and the maintenance of adequate soil moisture are major problems.

The soils in this unit are—

(DhA)	Delhi sand, 0 to 3 percent slopes.
(DnB)	Delhi sand, 3 to 8 percent slopes.
(TvA)	Tujunga sand, 0 to 3 percent slopes.

Use and management.—These soils are suitable for deep-rooted crops, such as orchard fruits, alfalfa, and vineyards. They require management similar to that of capability unit IIIe–4. They need, however, more frequent, light applications of water and larger amounts of fertilizer and organic matter. Areas with slopes that cannot be leveled to less than 1 percent should be irrigated by sprinklers. Surface irrigation should be made with small heads and short runs; large heads of water may cause severe erosion. Sprinkler irrigation is best suited to these soils.

Capability unit IVe–5

This unit consists of fine-textured, sloping to hilly, well-drained, shallow to moderately deep soils of the uplands. These soils are severely limited by fine texture and slope. Except for their steeper slopes, they are similar to the soils of capability unit IIIs–5.

The soils in this unit are—

(PtC)	Peters clay, 8 to 15 percent slopes.
(PvC)	Peters cobbly clay, 8 to 15 percent slopes.
(RaC)	Raynor clay, 8 to 15 percent slopes.
(RoC)	Raynor cobbly clay, 8 to 15 percent slopes.
(ZaC)	Zaca clay, 8 to 15 percent slopes.
(ZaD)	Zaca clay, 15 to 30 percent slopes.

Use and management.—These soils are suitable for dry-farmed grain, irrigated pasture, and range. Water for irrigation is generally not available. Where water can be obtained, irrigated pasture is the best crop. Sprinklers would be the best method of irrigation. Cobbles must be removed before the cobbly phases of Peters and Raynor soils can be cultivated.

When the soils are cultivated, cross-slope cultivation and crop residues should be used to reduce the erosion hazard.

Other management practices for the soils of this unit are the same as for the soils in capability unit IIIs–5.

Capability unit IVw–4

This unit consists of imperfectly to very poorly drained, moderately deep to very deep soils of the wind-modified alluvial fans. These soils are suited to occasional cultivation, but they are severely restricted by wetness and coarse texture. The soils are in depressions in the windblown sands. They have a high water table much of the time. Some of the soils are slightly to moderately saline-alkali. Salts and alkali occur throughout the subsoil and may affect up to 70 percent of the surface soil. Except for poorer drainage, the soils of this unit are similar to those of capability unit IIIw–4.

The soils in this unit are—

(DkA)	Dello loamy sand, 0 to 1 percent slopes.
(HfeA)	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes.
(HkaA)	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes.

Use and management.—These soils are suitable for shallow-rooted crops, such as grain and pasture.

Management practices are similar to those of capability unit IIIw–4. Unless the soils are drained and cultivated, wind erosion is less of a hazard than on the soils in capability unit IIIw–4. Drainage is difficult because of the depressions. Before crops are planted, these soils must be drained by pumping or tile, and the depressions must be filled by leveling.

Capability unit IVw–6

Only one soil is in this unit. It is poorly drained, moderately saline-alkali, moderately fine textured, and shallow to moderately deep. It occurs in basin areas.

This soil is severely restricted because it is wet and moderately saline-alkali. It is a clay loam with very slow runoff and permeability. The salts and alkali occur throughout the subsoil and affect more than 70 percent of the surface soil. As this soil has a high water table and is moderately saline alkali, reclamation is difficult. The water table is within 5 feet of the surface during most of the year. The vegetation is meager on much of the soil.

The soil in this unit is—

(RkA) Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes.

Use and management.—Management practices are the same for this soil as for the soils in capability unit IIIw–6. Drainage, however, is essential and should keep the water table at a fairly uniform level. This soil needs reclamation measures similar to those discussed for capability unit IIIw 6. Larger amounts of water and gypsum, however, and more time are required to reclaim this soil.

Large areas of this soil are used as dryland pasture and should be managed like the areas of soils in capability unit VIs–8.

Capability unit IVs–3

In this unit are shallow, moderately coarse to moderately fine textured, well-drained soils of the terraces and uplands. These soils are severely limited by shallowness. They are on gently sloping or undulating terraces and upland areas. They are generally less than 20 inches deep over hardpan, claypan, or semiconsolidated material. The surface soil is readily penetrated by roots and water, but the subsoil is almost impervious. The soils in this unit are similar to the soils of unit IVe-3 but have more gentle slopes. The Dinuba soils are included in this unit because their shallow depth is more important than their imperfect drainage.

The soils in this unit are—

(DnA) Dinuba fine sandy loam, shallow, 0 to 1 percent slopes.
(DsA) Dinuba sandy loam, shallow, 0 to 1 percent slopes.
(DyA) Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes.
(MaA) Madera loam, 0 to 2 percent slopes.
(MdA) Madera sandy loam, 0 to 2 percent slopes.
(MeA) Madera-Alamo complex, 0 to 2 percent slopes.
(SaA) San Joaquin sandy loams, 0 to 3 percent slopes.
(SmA) San Joaquin and Madera soils, 0 to 3 percent slopes.
(YkA) Yokohl loam, 0 to 1 percent slopes.
(YoA) Yokohl clay loam, 0 to 3 percent slopes.

Use and management.—These soils are best suited to shallow-rooted crops, such as field crops, irrigated pasture, grain, and range.

The soils are low in nutrients, especially nitrogen and phosphorus. Dry-farmed grain and range respond to nitrogen and phosphorus. Irrigated nonlegumes respond to nitrogen, and legumes respond to phosphorus and sulfur. The use of crop rotations and crop residues helps maintain organic matter and soil structure.

When these soils are irrigated, careful practices are required to prevent waterlogging, a perched water table, and reduced aeration. Frequent, light irrigations should be used. Sprinkler irrigation is best for the undulating areas.

Because of the restricted rooting depth, shallow cuts should be used in leveling these soils. Deeper cuts will expose the underlying hardpan or semiconsolidated material.

When these soils are used for range, they should be managed like the soils in capability unit VIe–3.

Capability unit IVs–6

This unit consists of strongly saline-alkali, moderately coarse textured, well-drained soils of the basins. These soils are severely restricted because they are strongly saline-alkali. Their texture is sandy loam. They are slowly permeable. Salts and alkali occur throughout the subsoil and affect more than 70 percent of the surface soil. Vegetation is meager or almost absent in large areas. Reclamation is difficult because of the salts and alkali.

The soils in this unit are—

(ToA) Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.
(TsA) Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes.

Use and management.—Crops such as irrigated pasture and grain that tolerate strongly alkali soils are suitable.

Reclamation requires large amounts of gypsum and water and much time. The soils should be carefully leveled to grade. Gypsum should be worked into the surface layer before planting and leaching. Leaching with excess water helps remove the salts and alkali.

The soils are low in natural fertility and in organic matter. Grains and grasses respond to nitrogen, and legumes respond to phosphorus. Organic matter aids in reclamation of these soils. The use of manure, green-manure crops, crop residues, and crop rotations helps maintain organic matter.

When these soils are used as dryland pasture, they should be managed like the soils in unit VIs–8.

Capability unit IVs–8

This unit is made up of shallow, moderately saline-alkali, moderately coarse textured, very slowly permeable soils of the basins and low terraces. These soils are severely restricted because they are shallow and moderately saline-alkali. They are sandy loams and fine sandy loams, 10 to 20 inches deep over hardpan or claypan. Salts and alkali occur throughout the subsoil and affect 20 to 70 percent of the surface soil. Reclamation is difficult. The soils in this unit are—

(DxA) Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(FrA) Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(FuA) Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(FxA) Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes.
(RnA) Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes.
(WbA) Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.
(WeA) Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes.

Use and management.—The soils in this unit are best suited to shallow-rooted crops, such as grain and pasture, that tolerate moderately alkali soils.

Management practices are the same for these soils as those for the soils in capability unit IIIs–8, but larger amounts of gypsum and water and more time are required for improvement.

When these soils are used as dryland pasture, they should be managed like the soils in capability unit VIs–8.

Capability unit VIe–3

In this unit are shallow, moderately coarse to fine textured, moderately to slowly permeable, rolling to hilly soils of the foothills and dissected terraces. These soils are subject to slight to moderate erosion and are shallow. Runoff is medium to rapid. The water-holding capacity is low. The natural fertility is low to moderate. The potential production for range is moderate. The soils are well drained.

The soils in this unit are—

(AuD) Auburn clay loam, 8 to 20 percent slopes.
(ExB) Exchequer and Auburn soils, 3 to 8 percent slopes.
(ExD) Exchequer and Auburn soils, 8 to 30 percent slopes.
(MtC2) Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded.
(PeB) Pentz gravelly loam, 3 to 8 percent slopes.
(PeD) Pentz gravelly loam, 8 to 30 percent slopes.
(PfB) Pentz loam, 3 to 8 percent slopes.
(PfD) Pentz loam, 8 to 30 percent slopes.
(PmD) Pentz loam, moderately deep, 15 to 30 percent slopes.
(PmD2) Pentz loam, moderately deep, 15 to 30 percent slopes, eroded.
(PoB) Pentz sandy loam, 3 to 8 percent slopes.
(PxB) Peters-Pentz complex, 0 to 8 percent slopes.
(PxC) Peters-Pentz complex, 8 to 15 percent slopes.

Use and management.—These soils are best suited to grazing. Proper use of the range is essential for maximum production and erosion control. Proper stocking is the most important practice. If the range has been properly grazed, the vegetation has a patchy appearance at the end of the grazing season. Livestock should be kept off the range until early in spring when the grass is 4 inches, or more, high. About 2 inches of stubble should be left at the end of the grazing period. Adequate water should be provided and salt placed so as to improve distribution of livestock. Selected sites are suitable for reseeding with annual grasses and legumes.

Fertilizer increases the quantity and quality of forage and lengthens the grazing season. A nitrogen-phosphate fertilizer should be used.

Cross fencing is essential for obtaining proper distribution of livestock and use of forage.

Removing brush and scrub trees from selected sites in Exchequer and Auburn soils increases production and improves plant cover. The areas should be reseeded after clearing.

The condition of the annual grasses shows whether the range has been well managed. The production of the range is maximum when—

1. The plant cover is:
   a. Approximately 70 percent desirable plants, such as soft chess, wild oats, annual clover, filaree, and small remnants of perennial grasses.
   b. Approximately 20 percent less desirable plants, such as ripgut, annual fescue, annual bluegrass, mouse barley, and lupines.
   c. Approximately 10 percent undesirable plants, such as nitgrass, fiddleneck, tarweed, and popcornflower.
2. The vegetation covers 60 to 75 percent of the ground.

3. There is little or no erosion.
4. Litter and residues are abundant, and there is partly decomposed vegetation on the ground.
5. Untouched or partly grazed plants are evident, and the range has a patchy appearance at the end of the grazing season.

Capability unit VIe–4

In this unit are moderately deep, moderately coarse textured soils of the rolling foothills. These soils are sandy loams that overlie softly consolidated granitic sediments at a depth of 20 to 36 inches. Permeability is moderately rapid to the granitic sediments but is very slow in the sediments. The moisture-holding capacity is low, and fertility is moderate to low. The erosion hazard is moderate to high, and adequate cover is essential for the protection of the soils.

The soils in this unit are—

(WmD) Whitney sandy loams, 15 to 30 percent slopes.
(WmD2) Whitney sandy loams, 15 to 30 percent slopes, eroded.

Use and management.—These soils are best suited to grazing. Proper use of the range is essential for maximum production and erosion control. Proper stocking is the most important practice. If the range has been properly grazed, the vegetation has a patchy appearance at the end of the grazing season. The plants should have a good early growth of at least 4 inches before they are grazed, and approximately 2 inches of stubble should remain at the end of the grazing season. Adequate watering places should be provided and salt placed so as to improve distribution of grazing.

Range reseeding is desirable in places where forage has been depleted by overgrazing and cultivation or where the soil has been cleared. Adapted annual grasses and legumes should be planted.

Areas that receive an average rainfall of more than 16 inches are suitable for fertilization. Fertilizer increases the quantity and quality of forage and lengthens the grazing season. A nitrogen-phosphate fertilizer should be used. These soils have a sulfur deficiency for legumes. Additions of sulfur will increase the quality if not the quantity of the forage produced.

Cross fencing is essential for obtaining proper distribution of livestock and use of forage.

The condition of the range is an indication of proper stocking, which is essential to good range management. The production of the range is maximum when—

1. The plant cover is:
   a. Approximately 70 percent desirable plants, such as soft chess, wild oats, burclover, filaree, and small amounts of perennial grasses.
   b. Approximately 20 percent less desirable plants, such as ripgut, annual fescue, annual bluegrass, mouse barley, and lupine.
   c. Approximately 10 percent undesirable plants, such as nitgrass, fiddleneck, tarweed, and popcornflower.
2. The vegetation covers 55 to 70 percent of the ground.
3. There is little or no erosion.

4. Litter and residue are abundant, and there is partly decomposed vegetation on the ground.
5. Untouched or partly grazed plants are evident, and the range has a patchy appearance at the end of the grazing season.

Capability unit VIe-9

This unit is made up of shallow, moderately coarse to medium textured, slowly to very slowly permeable, rolling to hilly soils of the dissected terraces. These soils are underlain by a claypan or hardpan at a depth of less than 20 inches. Runoff is medium to rapid, and the soils are well drained. The erosion hazard is slight to severe, depending on the slope. Most of the soils of this unit are mainly cobbly or gravelly. They have a low moisture-holding capacity and low fertility. Most of the soils have a low potential productivity. Some of the soils, however, are very acid and have very low potential productivity.

The soils in this unit are—

(CyD)	Corning gravelly sandy loam, 15 to 30 percent slopes.
(KeB)	Keyes cobbly clay loam, 0 to 8 percent slopes.
(MtD2)	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded.
(MtD3)	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded.
(PpB)	Pentz-Redding gravelly loams, 0 to 8 percent slopes.
(RcB)	Redding cobbly loam, 0 to 8 percent slopes.
(RcC)	Redding cobbly loam, 8 to 15 percent slopes.

Use and management.—These soils are best suited to grazing. Proper use of the range is essential for maximum production and erosion control. Proper stocking is the most important practice. If the range is properly grazed, the vegetation has a patchy appearance at the end of the grazing season. The plants should have a good early growth of at least 4 inches before they are grazed, and approximately 2 inches of stubble should remain at the end of the grazing season. Adequate watering places should be provided and salt placed so as to improve distribution of grazing.

The soils are suitable for reseeding to annual grasses and legumes if fertilized. Grasses respond to nitrogen, and legumes respond to phosphate. Fertilizer increases the quantity and quality of forage and lengthens the grazing season.

The condition of the range is an indication of proper stocking, which is essential to good range management. The production of the range is maximum when—

1. The plant cover is:
   a. Approximately 70 percent desirable plants, such as soft chess, wild oats, filaree, annual clover, annual trefoil, some burclover, and remnants of perennial grass.
   b. Approximately 20 percent less desirable plants, such as ripgut, red brome, annual fescue, mouse barley, and annual lupine.
   c. Approximately 10 percent undesirable plants, such as nitgrass, fiddleneck, tarweed, and larkspur.
2. The vegetation covers 45 to 55 percent of the ground.
3. There is little or no erosion.
4. Litter and residues are abundant, and there is partly decomposed vegetation on the ground.
5. Untouched or partly grazed plants are evident, and the range has a patchy appearance at the end of the grazing season.

Capability unit VIw-6

This unit consists of poorly drained, moderately to strongly saline-alkali, very slowly permeable soils of the basins. These soils are clay and have very slow permeability.

The soils in this unit are—

(RfA)	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes.
(RgA)	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes.
(RoA)	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes.

Use and management.—These soils are best used for saltgrass pasture and duck-hunting ponds. Surplus water may be spread over the soil to lengthen the pasture season. Reclamation is very difficult because of the large amounts of salts and alkali, the very slow permeability, and the high water table.

Capability unit VIs-8

This unit is made up of shallow, strongly saline-alkali, moderately coarse textured soils of the low terraces and basins. These soils are sandy loams and fine sandy loams that are underlain by a hardpan or claypan at a depth of 10 to 20 inches.

The soils in this unit are—

(FsA)	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.
(FvA)	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes.
(WcA)	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.

Use and management.—These soils are best suited to dryland pasture. Vegetation is meager or almost absent over large areas. It consists of saltgrass, alkali sacaton, jackass clover, and other alkali-tolerant plants.

Surplus water may be spread over these areas to lengthen the pasture season.

Capability unit VIIe-3

In this unit are very shallow to shallow, rolling to steep soils of the uplands and dissected terraces. These soils are shallow to very shallow, and rocky, stony, or cobbly. They are droughty and low to very low in fertility.

The soils in this unit are—

(EcF)	Exchequer rocky loam, 30 to 60 percent slopes.
(ErD)	Exchequer and Auburn rocky soils, 8 to 30 percent slopes.
(PeF)	Pentz gravelly loam, 30 to 75 percent slopes.
(PfE)	Pentz loam, 30 to 45 percent slopes.
(WhD)	Whiterock rocky silt loam, 8 to 30 percent slopes.
(WhF)	Whiterock rocky silt loam, 30 to 60 percent slopes.
(WkB)	Whiterock silt loam, 0 to 8 percent slopes.
(WmE2)	Whitney sandy loams, 30 to 45 percent slopes, eroded.

Use and management.—The soils of this unit are suited only to grazing. Yields are low. Most of the practices for range management discussed for the soils of capability unit VIe-3 are suitable for these soils. Reseeding and fertilizing, however, are not advisable.

The condition of the range is an indication of proper stocking. The production of the range is maximum when—

1. The plant cover is:
   a. Approximately 70 percent desirable plants, such as soft chess, wild oats, and filaree.
   b. Approximately 20 percent less desirable plants, such as ripgut, red brome, annual fescue, mouse barley, and annual lupine.
   c. Approximately 10 percent undesirable plants, such as fiddleneck, popcornflower, tarweed, and nitgrass.
2. The vegetation covers 60 to 75 percent of the ground.
3. There is little or no erosion.
4. There is partly decomposed vegetation on the ground.
5. Untouched or partly grazed plants are evident, and the range has a patchy appearance at the end of the grazing season.

Capability unit VIIe-9

This unit is made up of shallow to very shallow, undulating to steep, well to somewhat excessively drained, moderately coarse and medium textured soils of the uplands and dissected old alluvial fans. These soils are similar to the soils in capability unit VIe-9, except that they are more shallow, have low to very low fertility, and are on steeper slopes. In addition, rock outcrops and gravel are more common. Runoff is very slow to very rapid; permeability is moderate to moderately rapid, and the water-holding capacity is very low. The erosion hazard is slight to very high, unless adequate ground cover is left.

The soils in this unit are—

(AgB)	Amador gravelly loam, 0 to 8 percent slopes.
(AmB)	Amador loam, 0 to 8 percent slopes.
(AmD)	Amador loam, 8 to 30 percent slopes.
(AmF)	Amador loam, 30 to 60 percent slopes.
(HaB)	Toomes rocky loam, 0 to 8 percent slopes.
(HvB)	Hornitos fine sandy loam, 3 to 8 percent slopes.
(HvD)	Hornitos fine sandy loam, 8 to 30 percent slopes.
(HyB)	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes.
(HyD)	Hornitos gravelly fine sandy loam, 8 to 30 percent slopes.
(PcB)	Pentz cobbly loam, very shallow, 0 to 8 percent slopes.
(PcD)	Pentz cobbly loam, very shallow, 8 to 30 percent slopes.

Use and management.—The soils are suited only to grazing. Yields are very low because the soils are droughty, shallow, and very low in fertility. Except for reseeding and fertilization, the range management practices discussed for the soils in capability unit VIe-9 apply to these soils.

The condition of the range is an indication of proper stocking, which is essential to proper management. The production of the range is maximum when—

1. The plant cover is:
   a. Approximately 60 percent desirable plants, such as soft chess, annual clover, and filaree.
   b. Approximately 25 percent less desirable plants, such as ripgut, red brome, annual fescue, mouse barley, and annual lupine.
   c. Approximately 15 percent undesirable plants, such as fiddleneck, popcornflower, goldfield, and owl clover.
2. The vegetation covers 25 to 40 percent of the ground.
3. There is little or no erosion.
4. Litter and residue are adequate, and there is partly decomposed vegetation on the ground.
5. Untouched or partly grazed plants are evident, and there is a lightly grazed appearance at the end of the grazing season.

Capability unit VIIIs-1

In this unit are miscellaneous land types that are nonagricultural.

The following are in this unit—

(Dl)	Dredge and mine tailings.
(La)	Lava and sandstone rockland.
(Rr)	Riverwash.
(Sc)	Schist rockland.
(Tt)	Tuff rockland.
(Tx)	Terrace escarpments.

Use and management.—These land types are suitable only for wildlife, watersheds, and recreation.

Yield Estimates and Soil Management Practices

The yield estimates and management practices in this report (table 4) are based on observations made by the soil scientists who surveyed the Area, on information furnished by farmers, and on suggestions furnished by crop specialists in the Agricultural Extension Service, the Soil Conservation Service, and the California Agricultural Experiment Station. Federal and county census records and crop data were also reviewed and considered. More information was available for some soils than for others. If little or no information was available for a particular soil or if the specified crop is not grown on the soil, yield estimates were made by comparison with similar soils.

Table 4 gives the yields of the principal crops grown in the Area under two levels of management, designated as A and B. The management levels are defined as follows:

A. Common, or average, management—the level of management most commonly used by farmers of the Area.
B. Optimum or best management known (actually applied or not)—the level of management that, according to experience, field trials, and research findings, would give the highest possible returns at the present time.

Several important limitations should be kept in mind when using the yield estimates in table 4. First, the figures are estimates, or predictions. Second, the figures are averages that may be expected over a period of years. In any given year, the yield may be considerably higher or lower than the average. Third, there is considerable variation within some soils—for example, variations due to salts and alkali—and this fact was considered in making the estimates.

TABLE 4.—*Estimated average acre yields of*

[In columns A are estimates of yields obtained under common, or average, management, and in columns B are estimates of yields obtained suited. Details of each level of management are

Map symbol	Capability unit	Soil	Irrigated crops					
			Almonds (lb./acre)		Alfalfa (tons/acre)		Barley (100 lb./acre)	
			A	B	A	B	A	B
AcA	IIIw-5	Alamo clay, 0 to 1 percent slopes	-----	-----	-----	-----	10	20
AgB	VIIe-9	Amador gravelly loam, 0 to 8 percent slopes	-----	-----	-----	-----	-----	-----
AmB	VIIe-9	Amador loam, 0 to 8 percent slopes	-----	-----	-----	-----	-----	-----
AmD	VIIe-9	Amador loam, 8 to 30 percent slopes	-----	-----	-----	-----	-----	-----
AmF	VIIe-9	Amador loam, 30 to 60 percent slopes	-----	-----	-----	-----	-----	-----
AnA	IIIs-4	Anderson gravelly fine sandy loam, 0 to 3 percent slopes	1, 000	2, 000	3	7	20	30
AnB	IIIs-4	Anderson gravelly fine sandy loam, 3 to 8 percent slopes	-----	[3] 2, 000	-----	[3] 6	-----	[3] 25
AoA	IIIs-4	Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes.	-----	-----	-----	-----	-----	-----
AuB	IVe-3	Auburn clay loam, 3 to 8 percent slopes	-----	-----	-----	-----	-----	[3] 20
AuD	VIe-3	Auburn clay loam, 8 to 20 percent slopes	-----	-----	-----	-----	-----	-----
BcA	IIs-3	Bear Creek clay loam, 0 to 3 percent slopes	-----	-----	4	8	25	35
BeA	IVe-3	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes	-----	-----	-----	-----	-----	-----
BgA	IIs-3	Bear Creek gravelly loam, 0 to 3 percent slopes	-----	-----	3	7	20	30
BmA	IIs-3	Bear Creek loam, 0 to 3 percent slopes	-----	-----	4	8	25	35
CaA	IIs-7	Chualar sandy loam, 0 to 3 percent slopes	1, 000	2, 000	5	8	25	35
CbA	IIs-6	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes	-----	-----	4	7	20	30
CcA	IIw-2	Columbia fine sandy loam, 0 to 1 percent slopes	-----	-----	7	10	30	40
CdA	IIIw-6	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes.	-----	-----	-----	-----	25	35
CeA	IIw-2	Columbia loam, 0 to 1 percent slopes	-----	-----	7	10	30	45
CfA	IIw-2	Columbia silt loam, 0 to 1 percent slopes	-----	-----	7	10	30	45
CgA	IIw 2	Columbia silt loam, slightly saline, 0 to 1 percent slopes	-----	-----	7	10	25	35
ChA	IIIw-3	Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes.	-----	-----	4	8	20	30
CkA	IIw-2	Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes.	-----	-----	5	9	25	35
CmA	IIw-2	Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes.	-----	-----	4	8	20	30
CoA	IIw-2	Columbia silty clay loam, slightly saline, 0 to 1 percent slopes	-----	-----	7	10	30	35
CpA	IIw 2	Columbia soils, 0 to 1 percent slopes	-----	-----	4	7	20	25
CsB	IIIe-4	Columbia soils, channeled, 0 to 8 percent slopes	-----	-----	-----	[3] 6	-----	[3] 25
CyB	IVe-3	Corning gravelly sandy loam, 3 to 8 percent slopes	-----	-----	-----	-----	-----	[3] 25
CyC	IVe-3	Corning gravelly sandy loam, 8 to 15 percent slopes	-----	-----	-----	-----	-----	-----
CyD	VIe-9	Corning gravelly sandy loam, 15 to 30 percent slopes	-----	-----	-----	-----	-----	-----
DeA	IIIe-4	Delhi loamy sand, 0 to 3 percent slopes	800	1, 600	5	8	20	30
DeB	IIIe-4	Delhi loamy sand, 3 to 8 percent slopes	-----	[3] 2, 000	-----	[3] 7	-----	[3] 30
DfA	IIIe-4	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes.	-----	-----	4	7	20	30
DgA	IIIe-4	Delhi loamy sand, silty substratum, 0 to 3 percent slopes	1, 000	2, 000	6	9	20	30
DhA	IVe-4	Delhi sand, 0 to 3 percent slopes	300	800	3	7	10	[2] 20
DhB	IVe-4	Delhi sand, 3 to 8 percent slopes	-----	-----	-----	[3] 6	-----	[3] 20
DkA	IVw-4	Dello loamy sand, 0 to 1 percent slopes	-----	-----	2	6	15	25
DmA	IIw-3	Dinuba fine sandy loam, 0 to 1 percent slopes	-----	1, 400	6	9	25	40
DnA	IVs-3	Dinuba fine sandy loam, shallow, 0 to 1 percent slopes	-----	-----	4	7	15	25
DoA	IIw-3	Dinuba fine sandy loam, deep, 0 to 1 percent slopes	1, 000	2, 000	7	10	25	40
DpA	IIw-3	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	-----	-----	5	8	20	30
DrA	IIw-3	Dinuba sandy loam, 0 to 1 percent slopes	-----	1, 200	6	9	20	35
DsA	IVs-3	Dinuba sandy loam, shallow, 0 to 1 percent slopes	-----	-----	4	7	15	25
DtA	IIw-3	Dinuba sandy loam, deep, 0 to 1 percent slopes	1, 000	2, 000	7	10	20	35
DwA	IIw-3	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes	-----	-----	5	8	20	30
DxA	IVs-8	Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	-----	-----	-----	-----	15	[4] 25
DyA	IVs-3	Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes.	-----	-----	-----	-----	12	20
DuA	IIIw-3	Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes	-----	-----	-----	-----	-----	-----
DzA	IIIw-6	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes.	-----	-----	-----	-----	-----	-----
Dl	VIIIs-1	Dredge and mine tailings	-----	-----	-----	-----	-----	-----
EcF	VIIe-3	Exchequer rocky loam, 30 to 60 percent slopes	-----	-----	-----	-----	-----	-----

See footnotes at end of table.

principal crops under two levels of management

under optimum management. No estimates are given for soils on which a particular crop is not grown or for soils to which a crop is not given for principal crops in tables 5 through 15]

Irrigated crops—Continued														Dryland crops			
Beans (blackeye) (100 lb./acre)		Corn (silage) (tons/acre)		Grapes				Pasture (cow-acre-months [1])		Peaches (clingstone) (tons/acre)		Walnuts (lb./acre)		Dry-farmed barley (100 lb./acre)		Range pasture (cow-acre-days [2])	
				Wine (tons/acre)		Other (tons/acre)											
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
5	10	--	--	--	--	--	--	4	8	--	--	--	--	10	15	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	25
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	10
7	15	7	15	4	8	6	12	7	14	10	18	1,500	2,500	15	20	25	45
--	[3] 13	--	--	--	[3] 8	--	[3] 12	7	14	--	[3] 18	--	[3] 2,200	15	20	20	40
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	40
--	[3] 12	--	--	--	--	--	--	5	10	--	--	--	--	10	15	20	40
--	--	--	--	--	--	--	--	--	--	--	--	--	--	8	14	20	40
6	12	10	20	4	7	5	11	7	14	--	--	--	--	20	30	35	50
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30	45
7	14	8	16	4	8	6	12	8	16	--	--	--	--	15	20	40	60
8	15	10	20	4	8	6	12	8	16	--	--	--	--	20	30	40	60
8	16	8	16	5	9	7	13	8	16	10	18	1,500	2,500	15	20	30	50
8	14	6	[4] 14	--	--	--	--	7	13	--	--	--	--	12	18	20	40
10	20	15	25	--	--	--	--	12	20	--	--	--	--	20	30	40	60
6	[4] 12	--	--	--	--	--	--	7	15	--	--	--	--	15	20	30	50
10	20	15	25	--	--	--	--	12	20	--	--	--	--	20	30	50	80
10	20	15	25	--	--	--	--	12	20	--	--	--	--	20	30	50	80
8	16	10	[4] 15	--	--	--	--	10	18	--	--	--	--	18	25	45	60
7	14	--	--	--	--	--	--	10	18	--	--	--	--	10	15	30	50
10	20	15	20	--	--	--	--	12	20	--	--	--	--	18	25	50	80
8	16	12	[4] 18	--	--	--	--	10	18	--	--	--	--	15	20	45	60
7	12	12	[4] 18	--	--	--	--	10	18	--	--	--	--	15	20	45	60
7	15	10	15	--	--	--	--	8	16	--	--	--	--	12	17	20	40
--	[3] 12	--	--	--	--	--	--	6	15	--	--	--	--	12	17	20	40
5	[3] 10	--	--	--	--	--	--	6	12	--	--	--	--	12	17	15	35
--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	15	10	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	30
8	16	8	15	4	8	6	12	6	10	10	18	1,500	2,500	--	--	10	20
--	[3] 14	--	--	--	[3] 8	--	[3] 12	--	[3] 10	--	[3] 18	1,200	[3] 2,500	--	--	10	20
9	18	10	18	4	8	6	12	6	10	--	--	--	--	--	--	10	20
9	18	10	18	5	7	7	13	6	10	10	18	1,500	2,500	--	--	10	20
5	10	5	10	4	6	5	9	--	--	8	14	1,000	1,800	--	--	5	15
--	[3] 8	--	--	--	[3] 6	--	[3] 9	--	--	--	[3] 14	1,000	1,800	--	--	5	15
6	12	7	15	--	--	--	--	6	10	--	--	--	--	15	20	15	30
8	16	10	20	6	9	7	12	9	18	8	15	1,000	1,800	18	25	40	60
5	10	5	10	4	7	5	9	7	14	--	--	--	--	15	20	30	45
8	16	10	20	7	10	9	14	9	18	12	18	1,500	2,500	20	30	40	60
7	14	7	15	3	[4] 7	4	[4] 10	7	14	--	--	--	--	12	18	30	45
8	16	10	20	6	9	7	12	9	18	8	15	1,000	1,800	18	25	30	50
6	12	5	10	4	7	5	9	7	14	--	--	--	--	15	20	25	40
8	16	10	20	7	10	9	14	9	18	12	18	1,500	2,500	18	25	30	50
7	14	8	15	3	[4] 7	4	[4] 10	7	14	--	--	--	--	12	18	20	40
--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	15	15	30
6	10	--	--	--	--	--	--	6	12	--	--	--	--	10	15	20	30
--	--	--	--	--	--	--	--	7	14	--	--	--	--	--	--	30	50
--	--	--	--	--	--	--	--	6	12	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20

TABLE 4.—*Estimated average acre yields of*

Map symbol	Capability unit	Soil	Irrigated crops					
			Almonds (lb./acre)		Alfalfa (tons/acre)		Barley (100 lb./acre)	
			A	B	A	B	A	B
ErD	VIIe-3	Exchequer and Auburn rocky soils, 8 to 30 percent slopes						
ExB	VIe-3	Exchequer and Auburn soils, 3 to 8 percent slopes						
ExD	VIe-3	Exchequer and Auburn soils, 8 to 30 percent slopes						
FoA	IIIw-6	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes.						
FpA	IIIs-8	Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.					15	25
FrA	IVs-8	Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.					10	[4] 20
FsA	VIs-8	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.						
FtA	IIIs-8	Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes					12	20
FuA	IVs-8	Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes						
FvA	VIs-8	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes						
FwA	IIIs-8	Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes.					12	20
FxA	IVs-8	Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes.					10	[4] 20
GfA	IIw-2	Grangeville fine sandy loam, 0 to 1 percent slopes	1, 000	2, 000	7	10	25	40
GgA	IIw-2	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.			6	9	20	35
GhA	IIw-2	Grangeville sandy loam, 0 to 1 percent slopes	1, 000	2, 000	7	10	25	35
GkA	IIw-2	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes.			6	9	20	30
GmA	IIw-2	Grangeville very fine sandy loam, 0 to 1 percent slopes	1, 000	2, 000	8	10	30	45
GnA	IIw-2	Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.			7	9	25	35
GoA	IIIw-6	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.					10	[4] 25
GrA	I-1	Greenfield fine sandy loam, 0 to 3 percent slopes	1, 500	3, 000	7	10	30	45
GsA	I-1	Greenfield sandy loam, 0 to 3 percent slopes	1, 500	3, 000	7	10	25	40
GsB	IIe-1	Greenfield sandy loam, 3 to 8 percent slopes		[3] 3, 000	6	[3] 9	20	[3] 35
GvA	IIs-3	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes	1, 000	2, 000	6	9	20	35
HbA	I-1	Hanford fine sandy loam, 0 to 3 percent slopes	1, 500	3, 000	7	10	25	40
HbmA	IIIs-4	Hanford fine sandy loam, moderately deep over sand, 0 to 3-percent slopes.			5	8	15	30
HbpA	I-1	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes.[5]	1, 200	2, 500	7	10	30	45
HbsA	I-1	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes [5]	1, 500	3, 000	7	10	30	45
HcA	IIIs-4	Hanford gravelly sandy loam, 0 to 3 percent slopes	1, 000	2, 000	4	8	20	30
HdA	I-1	Hanford sandy loam, 0 to 3 percent slopes	1, 500	3, 000	7	10	25	40
HdB	IIe-1	Hanford sandy loam, 3 to 8 percent slopes		[3] 3, 000	6	[3] 9	20	[3] 35
HdC	IVe-1	Hanford sandy loam, 8 to 15 percent slopes		[3] 2, 000	5	[3] 8		
HddA	IIw-2	Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes			5	8	15	25
HdmA	IIIs-4	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes.			4	7	12	25
HdpA	IIs-3	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes.[5]	1, 200	2, 500	7	10	25	40
HdsA	I-1	Hanford sandy loam, deep over silt, 0 to 1 percent slopes [5]	1, 500	3, 000	7	10	25	40
HeA	I-1	Hanford very fine sandy loam, 0 to 1 percent slopes	1, 000	2, 000	7	10	30	45
HfA	IIIw-4	Hilmar loamy sand, 0 to 1 percent slopes			5	8	15	30
HfdA	IIIw-4	Hilmar loamy sand, deep, 0 to 1 percent slopes			5	8	15	30
HkbA	IIIw-4	Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes			4	7	15	30
HfeA	IVw-4	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes.						
HkaA	IVw-4	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes.						
HmA	IIIw-4	Hilmar sand, 0 to 3 percent slopes			3	7	10	20
HnA	I-1	Honcut clay loam, 0 to 1 percent slopes	1, 000	2. 500	7	10	25	40
HoA	I-1	Honcut fine sandy loam, 0 to 1 percent slopes	1, 500	3, 000	7	10	30	45
HpA	I-1	Honcut loam, 0 to 1 percent slopes	1, 000	3, 000	7	10	30	45
HrA	I-1	Honcut sandy loam, 0 to 1 percent slopes	1, 500	3, 000	7	10	25	40
HsB	IIIs-5	Hopeton clay, 3 to 8 percent slopes					12	[3] 20
HtA	IIIs-3	Hopeton clay loam, 0 to 3 percent slopes			4	7	20	30

See footnotes at end of table.

principal crops under two levels of management—Continued

Irrigated crops—Continued														Dryland crops					
Beans (blackeye) (100 lb./acre)		Corn (silage) (tons/acre)		Grapes: Wine (tons/acre)		Grapes: Other (tons/acre)		Pasture (cow-acre-months [1])		Peaches (clingstone) (tons/acre)		Walnuts (lb./acre)		Dry-farmed barley (100 lb./acre)		Range pasture (cow-acre-days [2])	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	10	20
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	20	30
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	20	30
------	------	------	------	------	------	------	------	5	10	------	------	------	------	------	------	20	40
5	10	------	------	------	------	------	------	6	12	------	------	------	------	10	15	20	30
------	------	------	------	------	------	------	------	4	8	------	------	------	------	------	------	15	25
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	5	10
5	10	------	------	------	------	------	------	6	12	------	------	------	------	10	15	15	25
------	------	------	------	------	------	------	------	4	8	------	------	------	------	8	12	10	20
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	5	10
6	12	------	------	------	------	------	------	6	12	------	------	------	------	10	15	20	30
------	------	------	------	------	------	------	------	4	8	------	------	------	------	8	12	15	25
10	20	15	25	------	------	------	------	10	20	10	16	1, 500	2, 500	20	30	50	80
9	18	10	20	------	------	------	------	9	18	------	------	------	------	18	25	45	70
9	18	10	20	------	------	------	------	10	20	10	16	1, 500	2, 500	20	30	40	60
8	16	7	[4] 15	------	------	------	------	9	18	------	------	------	------	18	25	35	50
10	20	15	25	------	------	------	------	10	20	10	16	1, 500	2, 500	20	30	50	80
9	18	10	20	------	------	------	------	9	18	------	------	------	------	18	25	45	70
5	[4] 12	------	------	------	------	------	------	7	14	------	------	------	------	15	20	35	50
10	20	10	20	7	10	9	14	10	20	13	20	1, 800	3, 000	20	30	40	70
9	18	10	20	7	10	9	14	9	18	13	20	1, 800	3, 000	20	30	30	60
8	[3] 16	------	------	5	9	7	13	8	16	------	[3] 20	1, 500	3, 000	20	30	30	60
9	18	10	20	5	9	7	13	9	18	10	16	1, 500	3, 000	20	30	30	60
10	20	10	20	7	10	9	14	10	20	13	20	1, 800	3, 000	20	30	45	75
6	14	6	13	5	8	6	11	7	14	8	14	1, 000	1, 800	11	14	25	45
10	20	10	20	7	10	9	14	10	20	12	20	1, 500	3, 000	20	30	45	75
10	20	15	25	7	10	9	14	10	20	13	20	1, 800	3, 000	20	30	45	75
8	16	8	15	5	9	7	13	7	14	10	16	1, 500	2, 500	15	20	20	40
10	18	10	20	7	10	9	14	9	18	13	20	1, 800	3, 000	20	30	30	60
8	[3] 16	------	------	5	9	7	13	8	16	------	[3] 20	1, 500	[3] 3, 000	20	30	30	60
------	------	------	------	4	[3] 8	5	12	6	[3] 12	------	[3] 18	------	[3] 2, 500	15	25	30	60
7	12	18	15	------	------	------	------	7	14	------	------	------	------	15	20	40	70
5	12	5	12	4	7	5	10	6	12	------	------	------	------	10	13	20	40
10	18	10	20	7	10	9	14	9	18	12	20	1, 500	3, 000	20	30	30	60
10	18	10	20	7	10	9	14	9	18	13	20	1, 800	3, 000	20	30	30	60
10	20	15	25	7	10	9	14	10	20	10	16	1, 500	2, 500	20	30	50	80
8	16	7	15	3	8	4	10	6	10	------	------	------	------	------	------	15	30
8	16	7	15	4	9	5	11	6	10	9	16	------	------	------	------	15	30
6	12	------	------	------	------	------	------	5	9	------	------	------	------	10	15	10	20
------	------	------	------	------	------	------	------	4	8	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	5	9	------	------	------	------	------	------	15	30
7	14	6	12	------	------	------	------	5	9	------	------	------	------	------	------	10	20
10	20	10	20	6	9	7	12	9	18	11	18	1, 500	2, 500	20	30	50	80
10	20	15	25	7	10	9	14	10	20	13	20	1, 800	3, 000	20	30	40	75
10	20	15	25	7	10	9	14	10	20	13	20	1, 800	3, 000	20	30	50	80
9	18	10	20	7	10	9	14	9	18	13	20	1, 800	3, 000	20	30	30	60
5	[3] 10	5	[3] 10	------	------	------	------	6	11	------	------	------	------	12	18	30	50
6	12	5	10	------	------	------	------	7	12	------	------	------	------	15	25	30	50

TABLE 4.—*Estimated average acre yields of*

Map symbol	Capability unit	Soil	Irrigated crops: Almonds (lb./acre) A	Almonds (lb./acre) B	Alfalfa (tons/acre) A	Alfalfa (tons/acre) B	Barley (100 lb./acre) A	Barley (100 lb./acre) B
HtB	IVe-3	Hopeton clay loam, 3 to 8 percent slopes					15	[3] 25
HuA	IIIs-3	Hopeton loam, 0 to 3 percent slopes			4	7	20	30
HuB	IVe-3	Hopeton loam, 3 to 8 percent slopes					15	[3] 25
HvB	VIIe-9	Hornitos fine sandy loam, 3 to 8 percent slopes						
HvD	VIIe-9	Hornitos fine sandy loam, 8 to 30 percent slopes						
HyB	VIIe-9	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes						
HyD	VIIe-9	Hornitos gravelly fine sandy loam, 8 to 30 percent slopes						
KeB	VIe-9	Keyes cobbly clay loam, 0 to 8 percent slopes						
KgB	IVe-3	Keyes gravelly clay loam, 0 to 8 percent slopes						
La	VIIIs-1	Lava and sandstone rockland						
MaA	IVs-3	Madera loam, 0 to 2 percent slopes					20	35
MdA	IVs-3	Madera sandy loam, 0 to 2 percent slopes					20	35
MdB	IVe-3	Madera sandy loam, 2 to 4 percent slopes						[3] 35
MeA	IVs-3	Madera-Alamo complex, 0 to 2 percent slopes					15	30
MkA	IIIw-5	Meikle clay, 0 to 1 percent slopes					15	30
MmA	IIs-7	Modesto clay loam, 0 to 1 percent slopes	800	1,600	4	7	15	30
MnA	IIs-6	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes			3	6	12	25
MoA	IIs-7	Modesto loam, 0 to 1 percent slopes	1,000	2,000	4	7	15	30
MpA	IIs-6	Modesto loam, slightly saline-alkali, 0 to 1 percent slopes			3	6	12	25
MtA	IIIs-3	Montpellier coarse sandy loam, 0 to 3 percent slopes	1,000	1,800	4	7	20	30
MtB	IVe-3	Montpellier coarse sandy loam, 3 to 8 percent slopes		[3] 1,600	3	[3] 6		[3] 25
MtC	IVe-3	Montpellier coarse sandy loam, 8 to 15 percent slopes						
MtC2	VIe-3	Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded						
MtD2	VIe-9	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded						
MtD3	VIe-9	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded.						
MvA	IIIw-3	Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes.						
OaA	I-1	Oakdale sandy loam, 0 to 3 percent slopes	1,200	2,500	7	10	25	40
PaA	IIIw-5	Paulsell clay, 0 to 1 percent slopes			3	7	20	30
PcB	VIIe-9	Pentz cobbly loam, very shallow, 0 to 8 percent slopes						
PcD	VIIe-9	Pentz cobbly loam, very shallow, 8 to 30 percent slopes						
PeB	VIe-3	Pentz gravelly loam, 3 to 8 percent slopes						
PeD	VIe-3	Pentz gravelly loam, 8 to 30 percent slopes						
PeF	VIIe-3	Pentz gravelly loam, 30 to 75 percent slopes						
PfB	VIe-3	Pentz loam, 3 to 8 percent slopes						
PfD	VIe-3	Pentz loam, 8 to 30 percent slopes						
PfE	VIIe-3	Pentz loam, 30 to 45 percent slopes						
PmB	IIIe-1	Pentz loam, moderately deep, 3 to 8 percent slopes		[3] 2,000				[3] 25
PmC	IVe-1	Pentz loam, moderately deep, 8 to 15 percent slopes						
PmC2	IVe-1	Pentz loam, moderately deep, 8 to 15 percent slopes, eroded						
PmD	VIe-3	Pentz loam, moderately deep, 15 to 30 percent slopes						
PmD2	VIe-3	Pentz loam, moderately deep, 15 to 30 percent slopes, eroded						
PoB	VIe-3	Pentz sandy loam, 3 to 8 percent slopes					15	20
PpB	VIe-9	Pentz-Redding gravelly loams, 0 to 8 percent slopes						
PtB	IIIs-5	Peters clay, 0 to 8 percent slopes					15	20
PtC	IVe-5	Peters clay, 8 to 15 percent slopes						
PvB	IIIs-5	Peters cobbly clay, 0 to 8 percent slopes						
PvC	IVe-5	Peters cobbly clay, 8 to 15 percent slopes						
PxB	VIe-3	Peters-Pentz complex, 0 to 8 percent slopes						
PxC	VIe-3	Peters-Pentz complex, 8 to 15 percent slopes						
RaA	IIIs-5	Raynor clay, 0 to 3 percent slopes					20	30
RaB	IIIs-5	Raynor clay, 3 to 8 percent slopes					20	[3] 30
RaC	IVe-5	Raynor clay, 8 to 15 percent slopes						
RbB	IIIs-5	Raynor cobbly clay, 0 to 8 percent slopes						
RbC	IVe-5	Raynor cobbly clay, 8 to 15 percent slopes						
RcB	VIe-9	Redding cobbly loam, 0 to 8 percent slopes						
RcC	VIe-9	Redding cobbly loam, 8 to 15 percent slopes						
RdB	IVe-3	Redding gravelly loam, 0 to 8 percent slopes						
Rr	VIIIs-1	Riverwash						
ReA	IIIs-3	Rocklin sandy loam, 0 to 3 percent slopes					25	35
ReB	IVe-3	Rocklin sandy loam, 3 to 8 percent slopes					20	35
RfA	VIw-6	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes						
RgA	VIw-6	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes						

See footnotes at end of table.

principal crops under two levels of management—Continued

Irrigated crops—Continued														Dryland crops			
Beans (blackeye) (100 lb./acre)		Corn (silage) (tons/acre)		Grapes				Pasture (cow-acre-months [1])		Peaches (clingstone) (tons/acre)		Walnuts (lb./acre)		Dry-farmed barley (100 lb./acre)		Range pasture (cow-acre-days [2])	
				Wine (tons/acre)		Other (tons/acre)											
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
5	[3] 10	5	[3] 10	--	--	--	--	7	12	--	--	--	--	15	25	30	50
6	12	5	10	3	7	4	8	8	13	--	--	--	--	15	25	30	50
5	[3] 10	5	[3] 10	3	[3] 7	4	[3] 8	7	12	--	--	--	--	15	25	30	50
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	15
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	15
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	40
--	--	--	--	--	--	--	--	6	11	--	--	--	--	--	--	20	40
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	16	--	--	2	6	4	8	9	15	--	--	--	--	15	20	20	40
10	16	--	--	2	6	4	8	9	15	--	--	--	--	15	20	15	30
--	[3] 14	--	--	2	[3] 6	4	[3] 8	8	14	--	--	--	--	15	20	15	30
6	12	--	--	--	--	--	--	7	12	--	--	--	--	15	20	20	40
5	10	5	10	--	--	--	--	6	12	--	--	--	--	10	15	25	45
7	14	6	12	4	8	6	10	7	15	--	14	1, 000	1, 800	15	20	30	50
6	12	5	10	--	--	--	--	6	14	--	--	--	--	14	18	25	45
7	14	7	14	5	9	7	12	8	16	8	16	1, 200	2, 000	15	20	30	50
6	12	6	12	--	--	--	--	7	15	--	--	--	--	15	20	25	45
7	14	6	12	4	9	6	12	6	15	--	15	1, 000	1, 800	15	20	10	35
--	[3] 12	--	[3] 12	4	[3] 9	6	[3] 12	5	[3] 15	--	[3] 14	--	--	15	20	10	35
--	--	--	--	3	[3] 8	5	[3] 11	--	--	--	--	--	--	12	17	10	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	15	10	25
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7	20
--	--	--	--			--	--	6	12	--	--	--	--	15	20	--	--
10	20	10	20	7	10	9	14	9	18	13	20	1, 800	3, 000	20	30	30	60
7	14	6	12	--	--	--	--	8	12	--	--	--	--	15	20	40	60
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	15
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	18
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	6	10	--	--	--	--	--	--	15	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	30
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	[3] 12	[3] 6	[3] 12	4	[3] 8	5	[3] 11	7	12	--	[3] 16	--	[3] 2, 000	18	25	30	50
--	--	--	--	--	[3] 7	--	[3] 10	--	[3] 12	--	--	--	--	15	20	30	50
--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	18	25	45
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25	45
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	40
--	--	--	--	--	--	--	--	7	12	--	--	--	--	10	15	15	30
--	--	--	--	--	--	--	--	6	10	--	--	--	--	--	--	15	25
5	10	5	10	--	--	--	--	6	11	--	--	--	--	15	20	45	70
--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	18	40	60
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	40	60
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	35	50
--	--	--	--	--	--	--	--	6	10	--	--	--	--	--	--	30	45
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30	45
7	14	6	12	--	--	--	--	7	12	--	--	--	--	15	20	45	70
6	[3] 12	6	[3] 12	--	--	--	--	6	11	--	--	--	--	15	20	45	70
--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	18	40	60
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	40	60
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	35	50
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10	20
--	--	--	--	--	--	--	--	5	10	--	--	--	--	--	--	15	25
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	15	--	--	--	--	--	--	9	15	--	--	--	--	15	20	20	35
7	14	--	--	--	--	--	--	7	14	--		--	--	15	20	20	35
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	10
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	10

691-267—64——8

TABLE 4.—*Estimated average acre yields of principal*

Map symbol	Capability unit	Soil	Irrigated crops: Almonds (lb./acre) A	Almonds (lb./acre) B	Alfalfa (tons/acre) A	Alfalfa (tons/acre) B	Barley (100 lb./acre) A	Barley (100 lb./acre) B
RkA	IVw–6	Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes	----	----	----	----	15	[4] 25
RnA	IVs–8	Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes.	----	----	----	----	15	25
RoA	VIw 6	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes.	----	----	----	----	----	----
RtA	IIIs–5	Ryer clay, 0 to 1 percent slopes	----	----	----	----	20	30
RvA	IIs–7	Ryer clay loam, 0 to 1 percent slopes	600	1, 200	6	8	25	40
RyA	IIs–7	Ryer loam, 0 to 1 percent slopes	700	1, 500	5	8	25	40
SaA	IVs–3	San Joaquin sandy loams, 0 to 3 percent slopes	----	----	----	----	20	35
SaB	IVe–3	San Joaquin sandy loams, 3 to 8 percent slopes	----	----	----	----	20	[3] 30
SmA	IVs–3	San Joaquin and Madera soils, 0 to 3 percent slopes	----	----	----	----	20	35
Sc	VIIIs 1	Schist rockland	----	----	----	----	----	----
SnA	IIs–7	Snelling sandy loam, 0 to 3 percent slopes	800	2, 000	6	9	25	40
SnB	IIe–1	Snelling sandy loam, 3 to 8 percent slopes	----	[3] 2, 000	5	[3] 8	20	[3] 35
SwA	IIIw–3	Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes	----	----	----	----	----	----
TbA	IIw–2	Temple loam, overwashed, 0 to 1 percent slopes	----	----	4	7	25	40
TcA	IIw–2	Temple loam, overwashed, slightly saline, 0 to 1 percent slopes	----	----	3	6	25	40
TdA and CnA	IIIw–6	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes.	----	----	----	----	20	[4] 35
TeA	IIIw–5	Temple silty clay, slightly saline, 0 to 1 percent slopes	----	----	----	----	15	25
TfA	IIIw–5	Temple silty clay, moderately saline, 0 to 1 percent slopes	----	----	----	----	10	[4] 25
TgA	IIw–2	Temple silty clay loam, 0 to 1 percent slopes	----	----	3	7	25	40
ThA	IIw–2	Temple silty clay loam, slightly saline, 0 to 1 percent slopes	----	----	3	6	25	40
TkA	IIIw–6	Temple silty clay loam, moderately saline, 0 to 1 percent slopes	----	----	----	----	20	35
Tx	VIIIs 1	Terrace escarpments	----	----	----	----	----	----
HaB	VIIe–9	Toomes rocky loam, 0 to 8 percent slopes	----	----	----	----	----	----
TmA	IIs–6	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	----	----	5	9	25	35
TnA	IIIs–6	Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	----	----	----	----	20	[4] 35
ToA	IVs–6	Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	----	----	----	----	----	----
TpA	IIs 6	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes	----	----	5	9	20	30
TrA	IIIs–6	Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	----	----	----	----	15	[4] 30
TsA	IVs–6	Traver sandy loam, strongly saline alkali, 0 to 1 percent slopes	----	----	----	----	----	----
Tt	VIIIs–1	Tuff rockland	----	----	----	----	----	----
TuA	IIIe 4	Tujunga loamy sand, 0 to 3 percent slopes	1, 000	2, 000	4	7	15	25
TuB	IIIe–4	Tujunga loamy sand, 3 to 5 percent slopes	----	----	3	[3] 6	----	[3] 25
TvA	IVe–4	Tujunga sand, 0 to 3 percent slopes	----	----	3	6	10	20
WaA	IIIs–8	Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes.	----	----	----	----	15	25
WbA	IVs–8	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	----	----	----	----	15	[4] 25
WcA	VIs–8	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes.	----	----	----	----	----	----
WdA	IIIs–8	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes	----	----	2	[4] 5	15	25
WeA	IVs–8	Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes.	----	----	----	----	15	[4] 25
WhD	VIIe 3	Whiterock rocky silt loam, 8 to 30 percent slopes	----	----	----	----	----	----
WhF	VIIe–3	Whiterock rocky silt loam, 30 to 60 percent slopes	----	----	----	----	----	----
WkB	VIIe–3	Whiterock silt loam, 0 to 8 percent slopes	----	----	----	----	----	----
WmB	IIIe–1	Whitney sandy loams, 3 to 8 percent slopes	----	[3] 1, 800	----	[3] 7	----	[3] 40
WmC	IVe–1	Whitney sandy loams, 8 to 15 percent slopes	----	----	----	----	[3] 20	[3] 35
WmC2	IVe–1	Whitney sandy loams, 8 to 15 percent slopes, eroded	----	----	----	----	----	----
WmD	VIe 4	Whitney sandy loams, 15 to 30 percent slopes	----	----	----	----	----	----
WmD2	VIe 4	Whitney sandy loams, 15 to 30 percent slopes, eroded	----	----	----	----	----	----
WmE2	VIIe–3	Whitney sandy loams, 30 to 45 percent slopes, eroded	----	----	----	----	----	----
WrA	IIIe 1	Whitney and Rocklin sandy loams, 0 to 3 percent slopes	----	----	3	6	20	35
WrB	IIIe–1	Whitney and Rocklin sandy loams, 3 to 8 percent slopes	----	----	3	[3] 6	[3] 20	[3] 35
WrC	IVe–1	Whitney and Rocklin sandy loams, 8 to 15 percent slopes	----	----	----	----	[3] 20	[3] 30
WtA	I–1	Wyman clay loam, 0 to 1 percent slopes	1, 000	2, 000	6	9	30	45
WvA	I–1	Wyman loam, 0 to 1 percent slopes	1, 500	3, 000	7	10	30	45

See footnotes at end of table.

crops under two levels of management—Continued

Irrigated crops—Continued														Dryland crops			
Beans (blackeye) (100 lb./acre)		Corn (silage) (tons/acre)		Grapes				Pasture (cow-acre-months [1])		Peaches (clingstone) (tons/acre)		Walnuts (lb./acre)		Dry-farmed barley (100 lb./acre)		Range pasture (cow-acre-days [2])	
				Wine (tons/acre)		Other (tons/acre)											
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
----	----	----	----	----	----	----	----	4	8	----	----	----	----	5	10	8	15
----	----	----	----	----	----	----	----	4	8	----	----	----	----	5	10	8	15
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	10
8	16	6	12	----	----	----	----	7	12	----	----	----	----	12	18	25	40
9	18	7	14	3	7	5	10	8	15	7	14	1, 000	1, 800	18	25	25	40
10	20	8	15	4	8	6	11	8	16	8	15	1, 200	2, 000	18	25	30	50
10	16	----	----	----	----	----	----	9	15	----	----	----	----	15	20	10	30
8	[3] 14	----	----	----	----	----	----	7	14	----	----	----	----	15	20	10	30
10	16	----	----	----	----	----	----	9	15	----	----	----	----	15	20	10	30
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9	18	8	15	5	9	7	12	7	15	10	18	1, 400	2, 200	18	25	15	40
7	[3] 14	[3] 7	[3] 14	4	[3] 9	6	[3] 12	6	14	----	[3] 18	1, 200	[3] 2, 200	18	25	15	40
----	----	----	----	----	----	----	----	6	12	----	----	----	----	15	20	----	----
8	16	10	20	----	----	----	----	8	16	----	----	----	----	18	25	50	80
7	14	8	16	----	----	----	----	7	15	----	----	----	----	18	25	45	70
5	10	----	----	----	----	----	----	6	12	----	----	----	----	12	18	40	60
6	12	----	----	----	----	----	----	6	12	----	----	----	----	15	20	35	50
----	----	----	----	----	----	----	----	5	10	----	----	----	----	10	15	30	45
8	16	8	16	----	----	----	----	8	13	----	----	----	----	15	20	45	70
7	14	6	12	----	----	----	----	8	13	----	----	----	----	15	20	40	60
5	10	----	----	----	----	----	----	6	11	----	----	----	----	12	18	35	50
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	30
6	12	6	12	----	----	----	----	7	13	----	----	----	----	12	18	20	40
5	10	----	----	----	[4] 7	----	[4] 10	6	[4] 12	----	----	----	----	10	15	15	30
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	10
6	12	5	10	----	[4] 7	----	[4] 10	7	13	----	----	----	----	12	18	20	40
5	10	----	----	----	----	----	----	6	[4] 12	----	----	----	----	10	15	15	30
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	10
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
7	15	7	15	4	8	6	12	6	10	10	17	1, 200	2, 500	----	----	15	30
----	[3] 12	----	----	----	[3] 7	----	[3] 11	5	[3] 10	----	[3] 16	1, 000	[3] 2, 500	----	----	15	30
5	10	5	10	4	6	5	9	----	----	8	14	1, 000	1, 800	----	----	10	20
5	10	----	----	----	----	----	----	6	12	----	----	----	----	10	15	15	30
----	----	----	----	----	----	----	----	5	10	----	----	----	----	----	----	10	20
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5	10
5	10	----	----	----	----	----	----	6	12	----	----	----	----	10	15	15	30
----	----	----	----	----	----	----	----	5	10	----	----	----	----	----	----	10	20
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	25
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10	20
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	30
----	[3] 12	----	[3] 12	----	7	----	[3] 10	7	14	----	[3] 16	----	[3] 1, 800	18	25	30	50
5	[3] 10	----	----	----	6	----	[3] 9	----	----	----	----	----	----	15	20	30	50
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	25	45
----	----	----	----	----	6	----	[3] 8	----	----	----	----	----	----	----	15	25	45
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	20	40
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	20	40
7	14	6	12	----	----	----	----	8	15	----	----	----	----	15	20	20	40
6	[3] 12	----	----	----	----	----	----	7	12	----	----	----	----	15	20	20	40
5	[3] 10	----	----	----	----	----	----	----	----	----	----	----	----	12	18	20	40
8	16	8	16	5	8	6	12	8	16	10	16	1, 200	1, 800	20	30	30	50
10	20	10	20	6	9	8	13	9	18	12	18	1, 500	2, 500	20	30	40	70

TABLE 4.—*Estimated average acre yields of principal*

Map symbol	Capability unit	Soil	Irrigated crops					
			Almonds (lb./acre)		Alfalfa (tons/acre)		Barley (100 lb./acre)	
			A	B	A	B	A	B
WyA	IIIs 3	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes			4	7	20	35
YkA	IVs-3	Yokohl loam, 0 to 1 percent slopes					25	40
YoA	IVs-3	Yokohl clay loam, 0 to 3 percent slopes					25	40
ZaB	IIIs-5	Zaca clay, 3 to 8 percent slopes					[3] 20	[3] 35
ZaC	IVe-5	Zaca clay, 8 to 15 percent slopes					[3] 20	[3] 35
ZaD	IVe-5	Zaca clay, 15 to 30 percent slopes						

[1] Number of months 1 animal unit (1 cow, 1 horse, 1 mule, 5 sheep, or 5 goats) can be grazed on an acre during the grazing season without damage to the pasture.

[2] Number of days 1 acre will provide grazing for 1 animal unit, without injury to the pasture, during the year.

[3] Based on sprinkler or contour-furrow irrigation.

The information on yields and management practices provided in this part of the report will be most useful and helpful immediately upon release of this report. New developments in crop breeding, control of insects and diseases, use of fertilizer, tillage, irrigation, and drainage will make obsolete much of the information on management. Newer and better practices can always be substituted, and the State and Federal farm advisory services are always ready to provide the latest information available.

Estimates of yields are of most use when the management practices under which such yields can be produced are specified. Tables 5 through 15 show, for each principal crop and for the soils of specific capability units, the

TABLE 5.—*Irrigated alfalfa* [1]

GROUP 1: CAPABILITY UNITS I-1 AND IIs-3

Practices	Management level	
	A	B
Rotation	Alfalfa 3 years, small grain—cash or truck crop double cropped 3 years.	Alfalfa 3 years, small grain—cash or truck crop double cropped 2 years; small grain—fallow 1 year.
Soil preparation	Grade less than 0.1 percent.	Grade less than 0.1 percent; make flat for 100 to 200 feet at lower end; chisel.
Seedbed preparation	Use disk, spring-tooth harrow, and spike harrow.	Use disk, spring-tooth harrow, spike harrow, and roller.
Seeding:		
Variety	Lahontan, Moapa.	Lahontan, Moapa.
Date	Oct. 15 to Dec. 15 or Jan. 20 to Mar. 15.	Oct. 15 to Dec. 15 or Jan. 20 to Mar. 15.
Fertilization	Dairy farms: 5 to 10 tons of manure per acre.	Dairy farms: 5 to 10 tons of manure and 1,000 pounds of gypsum or 300 pounds of superphosphate per acre.
Irrigation:		
Method [2]	Flood: checks 150 by 660 feet to 80 by 1,320 feet.	Flood: checks 80 by 400 feet to 100 by 300 feet.
Frequency	8 or 9 times; 5 inches of water per irrigation.	7 times; 4 or 5 inches of water per irrigation.
Total amount of water	3.5 to 4.0 feet.	2.5 to 3.0 feet.
Drainage	None.	Install drainage ditches where needed.
Cutting state	Cut at 0.1 bloom or at bud stage.	Cut at 0.1 bloom and cut once in winter.
Special practices	None.	Dry plow to control weeds and nematodes in fallow season.
Rodent control	None.	Poison or trap, or both.

See footnotes at end of table.

crops under two levels of management—Continued

Irrigated crops—Continued														Dryland crops			
Beans (blackeye) (100 lb./acre)		Corn (silage) (tons/acre)		Grapes				Pasture (cow-acre-months [1])		Peaches (clingstone) (tons/acre)		Walnuts (lb./acre)		Dry-farmed barley (100 lb./acre)		Range pasture (cow-acre-days [2])	
				Wine (tons/acre)		Other (tons/acre)											
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
7	15	7	15	----	----	----	----	----	----	10	14	----	----	15	20	30	50
7	14	5	10	2	6	4	8	9	15	8	14	----	----	15	20	20	40
7	14	5	10	----	----	----	----	8	15	7	13	----	----	15	20	20	40
[3] 7	[3] 14	[3] 5	[3] 10	----	----	----	----	8	12	----	----	----	----	15	20	45	70
----	----	----	----	----	----	----	----	----	10	----	----	----	----	12	18	45	70
----	----	----	----	----	----	----	----	----	----	----	----	----	----	10	15	40	60

[4] After salt or alkali reclamation, or both.
[5] This soil was described under the series name "Ripperdan" in University of California Soil Survey Report No. 13, Soils of Eastern Stanislaus County, California (*3*) and in some other University of California publications.

combination of practices that will produce the yields given in table 4 for the two defined levels of management—common (or average) and optimum. Tables 5 through 15 are useful only in relation to table 4. To use them, find in table 4 the crop, the name of the soil, the capability classification of the soil, the level of management, and the estimated yield; then look at the appropriate one of tables 5 through 15 to learn the details of management. For example, Bear Creek clay loam, 0 to 3 percent slopes (BcA) will, it is estimated, produce 4 tons of alfalfa per acre under common management (level A). This soil is in capability unit IIs-3. To find the combination of practices that will produce this amount of alfalfa, refer to table 5 and look in column A under group 1.

TABLE 5.—*Irrigated alfalfa* [1]—Continued

GROUP 2: CAPABILITY UNIT IIw-2

Practices	Management level A	Management level B
Rotation	Alfalfa 4 years, corn 2 years.	Alfalfa 3 years, cash or truck crop 3 years.
Fertilization	None.	1,000 pounds of gypsum or 300 pounds of superphosphate per acre.
Weed control	None.	Spray infested spots with chemical weedkiller.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 3: CAPABILITY UNITS IIIe-4 AND IIIs-4

Practices	Management level A	Management level B
Soil preparation	Grade less than 0.2 percent.	Grade 0.1 to 0.2 percent.
Fertilization	Same as for group 1.	300 pounds of superphosphate and 1,000 pounds of gypsum per acre in alternate years.
Irrigation:		
Method	Checks 75 by 660 feet to 150 by 300 feet.	Checks 75 to 100 feet by 300 feet or less.
Frequency	10 times.	8 or 9 times.
Total amount of water	4 feet.	2.5 to 3.0 feet.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 4: CAPABILITY UNIT IIIw-4

Practices	Management level A	Management level B
Drainage	None.	Level; install drainage ditches and pumps where possible; irrigate according to the results of examination of soil in localized areas.
All other practices	Same as for group 3.	Same as for group 3.

See footnote at end of table.

TABLE 5.—*Irrigated alfalfa*[1]—Continued

GROUP 5: CAPABILITY UNITS IIw-3 AND IIIw-3

Practices	Management level	
	A	B
Soil preparation	Same as for group 1.	Grade 0.1 percent throughout on soils shallower than 42 inches; make flat the lower one-fourth or one-third of fields of soils deeper than 42 inches; install drainage ditches.
Irrigation	Same as for group 1.	Same as for group 1, but control irrigation through tests made with soil augers or moisture meters.
All other practices	Same as for group 2.	Same as for group 2.

GROUP 6: CAPABILITY UNIT IIs-7

Practices	A	B
Soil preparation	Same as for group 1.	Grade 0.1 percent; level with care to avoid standing water.
Seeding date	Same as for group 1.	Oct. 15 to Dec. 15.
Cutting state	Same as for group 1.	Same as for group 1 (keep equipment off when soil is wet).
Irrigation method	Same as for group 1.	Checks 60 by 75 feet to 600 by 1,000 feet.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 7: CAPABILITY UNIT IVe-4[3]

Practices	A	B
Seeding date	Same as for group 1.	Nov. 15 to Dec. 15 or Jan. 20 to Mar. 15.
Special practices	None.	Provide windbreaks; to prevent wind erosion, avoid cultivation early in fall.
All other practices	Same as for group 3.	Same as for group 3.

GROUP 8: CAPABILITY UNITS IIs-6 AND IIIw-6

Practices	A	B
Special practices	None.	To remove alkali, apply 2,000 to 4,000 pounds of gypsum, according to results of soil tests and make several heavy irrigations before planting crop; install drainage ditches and pumps to lower the water to depth of 6 feet or more.
All other practices	Same as for group 5.	Same as for group 5.

GROUP 9: CAPABILITY UNIT IIIe-1

Practices	A	B
All practices	Same as for group 1, but irrigate with sprinklers and do not level fields.	Same as for group 1, but irrigate with sprinklers and do not level fields.

[1] Irrigated alfalfa not recommended for the soils of capability units not listed in this table.

[2] Based on a 15 cubic feet per second head of irrigation water; where less water is available, checks must be shorter, or narrower, or both.

[3] Soils of capability unit IVe-4 not well suited to alfalfa.

TABLE 6.—*Irrigated almonds* [1]

Practices	Management level A	Management level B
Group 1: Capability unit I-1		
Soil preparation	Grade 0.1 to 0.2 percent.	Grade 0.1 percent or less.
Pruning	Done every 2 to 4 years.	Selective pruning by year-round employees.
Fertilization	Ranges from none to 100 pounds of nitrogen per acre every other year (some growers wait to see how crop is progressing); zinc not used.	100 to 150 pounds of nitrogen per acre, according to top growth and yield; apply fertilizer between October and December; spray once a year with zinc.
Cover crop	None.	Plant 40 pounds per acre of winter rye where penetration of water needs to be improved.
Cultivation	Disk twice and landplane in preparation for harvest.	Disk 2 or 3 times and landplane and roll in preparation for harvest.
Irrigation:		
Method	Flood: 1,000 to 1,400 feet runs.	Flood: 600 to 800 feet runs.
Frequency	1 or 2 times.	4 or 5 times.
Total amount of water	12 to 18 inches.	36 inches.
Drainage	None. May allow water to pond at end of check.	Level land so that, by timing runs, ponding does not occur.
Harvest	Picked up by hand with little supervision.	Mechanically knock and pick up almonds and immediately hull and deliver them for fumigation.
Frost protection	None.	25 orchard heaters per acre and 1 pot per tree around perimeter of orchard.
Group 2: Capability unit IIe-1		
Irrigation	Contour checks.	Contour furrows or sprinklers.
All other practices	Same as for group 1.	Same as for group 1.
Group 3: Capability units IIs-3 and IIs-7		
Irrigation	Same as for group 1.	5 or 6 times; 4 inches of water per irrigation; use furrow irrigation on loams and clay loams.
All other practices	Same as for group 1.	Same as for group 1.
Group 4: Capability units IIIe-4 and IIIs-4		
Fertilization	Same as for group 1.	Total of 150 to 200 pounds of nitrogen per acre in 3 applications; apply according to top growth and yield; apply 2.5 tons per acre of manure.
Irrigation	Grade 0.2 to 0.3 percent.	Grade less than 0.2 percent; 4 to 5 inches of water per irrigation; use sprinklers on slopes of more than 1 percent
All other practices	Same as for group 1.	Same as for group 1.
Group 5: Capability unit IVe-4		
Fertilization	Same as for group 1.	Same as for group 4, except for 5 tons of manure per acre.
Irrigation	Grade 0.2 to 0.3 percent.	Sprinklers; 7 or 8 applications; total of 30 to 36 inches of water.
All other practices	Same as for group 1.	Same as for group 1.

[1] Irrigated almonds not recommended for soils of capability units not listed in this table.

TABLE 7.—*Irrigated beans (blackeye)*[1]

Practices	Management level A	Management level B
Group 1: Capability Units I–1 and IIs–3		
Rotation	Beans-small grain double cropped 2 years, beans-fallow 1 year, alfalfa 3 years.	Beans-small grain double cropped 2 years, beans-fallow 1 year, small grain-fallow 1 year, alfalfa 3 years.
Seedbed preparation	Disk twice; harrow.	Chisel or subsoil in fall; disk twice; harrow.
Fertilization	None.	5 to 10 tons of manure per acre.
Seeding:		
Variety	BE3 or BE5.	Certified BE3 or BE5.
Rate	20 pounds per acre, drilled.	20 pounds per acre, drilled.
Date	Single crop: May 15 to June 10. Double crop: June 10 to July 10.	Single crop: May 20 to June 1. Double crop: June 10 to June 20.
Seed treatment:		
Damping off	Fungicide.	Fungicide.
Wireworms	None.	Insecticide.
Lygus bugs	DDT or toxaphene.	DDT or toxaphene.
Irrigation:		
Method	Flood: checks.	Flood: semifurrows.
Frequency	Preirrigate and then irrigate 2 times.	Preirrigate and then irrigate 3 times.
Schedule	30 to 40 days after seeding and then 3 or 4 weeks later.	30 to 40 days after seeding and then 3 or 4 weeks later.
Amount of water	5 inches per irrigation.	4 or 5 inches per irrigation.
Drainage	None.	Install drainage ditches to remove excess water
Group 2: Capability unit IIw–2		
Special practices	None.	To promote seed formation, clip vines when they begin to intermingle.
All other practices	Same as for group 1.	Same as for group 1.
Group 3: Capability Units IIIe–4, IIIs–4, and IIIw–4		
Irrigation	Same as for group 1.	Same as for group 1, but preirrigate and then irrigate 3 or 4 times.
All other practices	Same as for group 1.	Same as for group 1.
Group 4: Capability Unit IIw–3		
Irrigation	6 inches of water per irrigation.	4 inches of water per irrigation.
All other practices	Same as for group 1.	Same as for group 1.
Group 5: Capability Unit IIs–7		
Seedbed preparation	Same as for group 1.	Level precisely to avoid standing water.
All other practices	Same as for group 1.	Same as for group 1.
Group 6: Capability Unit IVs–3		
Rotation	Small grain 1 year, fallow 1 year, beans (blackeye) 1 year.	Small grain 1 year, fallow 1 year, beans (blackeye) 1 year.
Seedbed preparation	Same as for group 1.	Deep plow or chisel in fall; harrow to control weeds and to save moisture in spring.
Irrigation:		
Method	Sprinklers.	Sprinklers.
Frequency	2 or 3 times.	2 or 3 times.
Amount of water	2 or 3 inches per irrigation.	3 or 4 inches per irrigation.
All other practices	Same as for group 1.	Same as for group 1.

[1] Irrigated beans (blackeye) not recommended for soils of capability units not listed in this table.

TABLE 8.—*Irrigated corn for silage on dairy farms* [1]

Practices	Management level A	Management level B
Group 1: Capability Units I-1, IIs-3, and IIw 2		
Rotation	Corn-small grain double cropped 3 years, alfalfa 3 years.	Corn-small grain double cropped 3 years, alfalfa 4 years.
Soil preparation	Grade less than 0.2 percent.	Grade less than 0.1 percent.
Seedbed preparation	Disk twice, harrow.	Chisel in fall if necessary; in spring plow, disk, harrow, and cultipack.
Seeding:		
Variety	Hybrid adapted to a short growing season or to one of medium length.	Hybrid adapted to a growing season of medium length.
Date	June 15 to July 15.	June 10 to June 20.
Rate	15 pounds per acre.	15 pounds per acre.
Seed treatment:		
Damping off	Fungicide.	Fungicide.
Wireworms	None.	Insecticide.
Fertilization	75 pounds of nitrogen per acre, or manure.	Manure and 75 pounds of nitrogen per acre.
Irrigation:		
Method	Flood: checks 1,000 to 1,320 feet long.	Flood: checks 400 to 660 feet long.
Frequency	Preirrigate and then irrigate 4 or 5 times.	Preirrigate and then irrigate 4 times.
Schedule	1. Before seeding. 2. When corn is 15 to 24 inches high. 3. 3 times at intervals of 10 to 14 days.	1. Before seeding. 2. When corn is 15 to 24 inches high. 3. 2 times at intervals of 10 to 14 days.
Amount of water	4 to 5 inches per irrigation.	4 to 5 inches per irrigation.
Group 2: Capability Unit IIIe-4		
Fertilization	Same as for group 1.	Manure and 100 pounds of nitrogen per acre in split applications.
Irrigation	Same as for group 1, except for one more irrigation.	Same as for group 1, except for one more irrigation and only 3 inches of water per irrigation.
All other practices	Same as for group 1.	Same as for group 1.
Group 3: Capability Unit IIw-3		
Irrigation	Same as for group 1, but do not apply more than 3 inches of water per irrigation.	Same as for group 1, but do not apply more than 3 inches of water per irrigation.
All other practices	Same as for group 1.	Same as for group 1.
Group 4: Capability Unit IIIw-4		
Drainage	Soils need drainage to be suitable for corn.	Soils need drainage to be suitable for corn.
All other practices	Where drained, same as for group 1.	Where drained, same as for group 1.
Group 5: Capability Unit IIIs-4		
Irrigation	Corn not recommended, but if it is grown, 6 to 8 light irrigations (3 inches of water per irrigation) or sprinkling will be required.	Corn not recommended, but if it is grown, 6 to 8 light irrigations (3 inches of water per irrigation) or sprinkling will be required.
All other practices	Same as for group 1.	Same as for group 1.
Group 6: Capability Unit IIs-7		
Irrigation	Same as for group 1, but apply no more than 4 inches of water per irrigation.	Same as for group 1, but apply no more than 4 inches of water per irrigation.
All other practices	Same as for group 1.	Same as for group 1.
Group 7: Capability Unit IIs-6		
Drainage	None.	Install drainage pumps or ditches.
Fertilization	Same as for group 1 and, in addition, 1 ton of gypsum per acre.	2 tons of gypsum (more on bad spots of alkali) in addition to manure and nitrogen fertilizer.
All other practices	Same as for group 1.	Same as for group 1.

See footnote at end of table.

TABLE 8.—*Irrigated corn for silage on dairy farms* [1]—Continued

GROUP 8: CAPABILITY UNITS IIIs-5 AND IIIw-5

Practices	Management level A	Management level B
Soil preparation	Level carefully so that irrigation water can be controlled and excess surface water can be removed.	Level carefully so that irrigation water can be controlled and excess surface water can be removed.
All other practices	Same as for group 1.	Same as for group 1.

[1] Irrigated corn for silage not recommended for soils of capability units not listed in this table.

TABLE 9.—*Irrigated grapes* [1]

GROUP 1: CAPABILITY UNITS I-1 AND IIs-3

Practices	Management level A	Management level B
Soil preparation	Level areas and build flood checks.	Level areas and build flood checks: chisel to depth of 8 to 12 inches; control weeds through fallowing.
Fertilization	Spray with zinc or daub on spur-pruned varieties.	Spray with zinc or daub on spur-pruned varieties; apply 50 pounds of nitrogen per acre and, late in fall, 2 tons of barnyard manure: do not use chicken manure.
Plant spacing:		
Wine grapes:		
Cordon pruned	8 by 12 feet.	8 by 12 feet.
Head pruned	8 by 12 feet.	8 by 12 feet.
Table grapes:		
Cordon pruned	8 by 12 feet.	8 by 12 feet.
Head pruned	8 by 12 feet.	8 by 12 feet.
Cane pruned	8 by 12 feet.	8 by 12 feet.
Grapes for raisins:		
Cane pruned	8 by 12 feet.	8 by 12 feet.
Irrigation:		
Method	Flat borders: checks, 48 to 60 feet by 800 feet.	Flat borders: checks at a maximum of 60 by 660 feet; furrows on loams and clay loams.
Schedule	June 10, 5 inches; July 20, 5 inches.	May 15, 5 inches; June 15, 6 inches; July 15, 6 inches; Aug. 15 (if summer is hot), 2 inches.
Total amount of water	10 inches.	Table grapes 23 inches, other grapes 17 inches.
Insect control:		
Thrips	At full bloom, apply 12 pounds of DDT per acre.	At full bloom, apply 12 pounds of DDT per acre.
Red spiders (if present)	Treatment is erratic.	Spray or dust organic phosphate in June.
Leafhopper (if present)	Apply Malathion, as required, in September.	Apply Malathion late in May.
Nematodes	None.	Fumigate; preplant.
Disease control:		
Mildew	Dust with sulfur 3 or 4 times, beginning when shoots are 12 to 15 inches long.	Dust with sulfur 3 or 4 times, beginning when shoots are 12 to 15 inches long.
Spanish measles	Apply sodium arsenite once before pruning or 6 weeks after pruning.	Apply sodium arsenite once before pruning or 6 weeks after pruning.
Cultivation	Disk after each irrigation; disk prunings in fall or early in spring.	Use spring tooth harrow or sweep after each irrigation; disk in fall or early in spring; if necessary, disk once to kill weeds; chop prunings.
Cover crop	None.	Plant rye early in fall and disk early in spring.

See footnote at end of table.

TABLE 9. *Irrigated grapes*[1]—Continued

Practices	Management level A	Management level B
GROUP 2: CAPABILITY UNITS IIe-1 AND IIIe-1		
Planting and leveling	Plant up and down slope or use deep cut leveling. (Reduce spacing to 8 by 10 feet in dry-farmed areas).	Grade or level to uniform slope and plant on the contour.
Irrigation	Furrows.	Contour furrows or sprinklers.
Varieties	Head-pruned varieties only.	Head-pruned varieties only.
Fertilization	(No fertilizer used for nonirrigated grapes.)	(No fertilizer used for nonirrigated grapes.)
All other practices	Same as for group 1.	Same as for group 1.
GROUP 3: CAPABILITY UNITS IIIe-4 AND IIIs-4		
Irrigation	Same as for group 1.	Checks 36 to 48 feet by 60 feet or 60 by 330 feet.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 4: CAPABILITY UNIT IIIe-4 (Soil on 3 to 8 percent slopes)		
Planting and irrigation	Same as for group 1.	Graded rows: plant and irrigate on grade of 0.5 to 1.0 percent; use short furrows (330 feet).
All other practices	Same as for group 1.	Same as for group 1.
GROUP 5: CAPABILITY UNIT IIw-3 (Soil free of salts and alkali)		
Irrigation	Furrows: apply water more frequently but use less water per irrigation than for group 1.	Furrows: apply water more frequently but use less water per irrigation than for group 1.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 6: CAPABILITY UNIT IIs-7		
Irrigation	Same as for group 1.	Furrows: 1 or 2 furrows per plant row.
Insect control	No fumigation needed.	No fumigation needed.
Disease control	Mildew control important.	Mildew control important.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 7: CAPABILITY UNIT IVe-1		
Irrigation	Same as for group 1.	Sprinklers used along with cross-slope planting and cultivating and the control of weeds with chemicals.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 8: CAPABILITY UNIT IVe-4		
Soil preparation	Graded rows, 0.25 to 0.5 percent.	Graded rows, not more than 0.2 to 0.4 percent; runs 330 feet, or sprinklers.
Fertilization	Apply barnyard manure, if available.	Apply 6 to 10 tons of barnyard manure and organic wastes per acre.
Irrigation:		
Method	Graded checks, 660 by 60 feet.	Graded checks, length 330 feet, width 36 to 48 feet; or sprinklers.
Frequency and amount	3 times.	4 or 5 times, 3 to 4 inches of water per irrigation.
Insect control	Same as for group 1.	Same as for group 1; control of red spider emphasized.
Disease control:		
Nematodes	No treatment.	Fumigate soil.
Cover crop	Weeds grow in winter.	Plant rye.

[1] Irrigated grapes not recommended for soils of capability units not listed in this table.

TABLE 10.—*Irrigated small grains* [1]

GROUP 1: CAPABILITY UNITS I–1, IIw–2, IIw–3, IIs–7, IIIe–4, AND IIIs–4

Practices	Management level A	Management level B
Rotation	Alfalfa 3 years, small grain-cash crop (such as beans) double cropped 3 years.	Alfalfa 3 years, small grain-cash crop (such as beans) double cropped 2 years, small grain-summer fallow cultivations 1 year.
Soil preparation	Grade less than 0.2 percent.	Grade less than 0.1 percent.
Seedbed preparation	Disk twice, harrow.	Chisel or subsoil; alternately disk and plow or vary depth of disk; harrow, ringroll.
Fertilization	0 to 30 pounds of nitrogen per acre before planting.	30 to 50 pounds of nitrogen per acre before planting.
Seeding:		
Variety	Oats: Kanota, California Red; barley: Arivat, California Mariout.	Oats: Kanota, California Red; barley: Arivat, California Mariout.
Rate	80 to 100 pounds per acre.	80 to 100 pounds per acre.
Date	Oats: Nov. 15 to Feb. 1; barley: Nov. 1 to Jan. 15.	Oats: Nov. 15 to Dec. 15; barley: Nov. 1 to Dec. 15.
Seed treatment	None.	N1 Ceresan.
Irrigation:		
Method	Flood: checks 1,000 to 1,310 feet long.	Flood: checks 660 to 880 feet long.
Frequency	1 or 2 times.	1 or 2 times.
Amount of water	5 inches per irrigation.	4 or 5 inches per irrigation.
Harvest date	Barley: June 1 to June 20.	Barley: May 25 to June 5.
GROUP 2: CAPABILITY UNIT IIs–6		
Seeding	Same as for group 1.	Barley: California Mariout.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 3: CAPABILITY UNIT IIIs–5		
Rotation	Same as for group 1, except no double cropping.	Same as for group 1, except no double cropping.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 4: CAPABILITY UNIT IVs–3		
Fertilization	Same as for group 1.	200 pounds of 16–20–0 per acre.
All other practices	Same as for group 1.	Same as for group 1.

[1] Irrigated small grains not recommended for soils of capability units not listed in this table.

TABLE 11.—*Dry-farmed small grains* [1]

GROUP 1: CAPABILITY UNITS IIIw–5, IIIs–3, IVe–3, AND IVs–3

Practices	Management level A	Management level B
Rotation	Barley 1 year, fallow 1 year.	Barley 1 year, fallow 1 year.
Seedbed preparation	Disk in fall, plow in spring; disk or use rodweeder as needed.	Plow in spring; disk or use rodweeder as needed.
Fertilization	Ranges from none to 75 pounds of 16–20–0 per acre sprayed by airplane.	100 pounds of 16–20–0 per acre at or before seeding.
Seeding:		
Variety	Barley: Tennessee Winter.	Barley: Malting, Tennessee Winter; or Arivat for feed.
Rate	80 to 100 pounds per acre.	80 to 100 pounds per acre.
Seed treatment	N1 Ceresan.	N1 Ceresan.

See footnote at end of table.

TABLE 11.—*Dry-farmed small grains* [1]—Continued

GROUP 2: CAPABILITY UNITS I-1, IIe-1, IIw-2, IIw-3, IIs-3, IIs-7, IIIe-1, IIIs-4, IIIs-5, IVe-1, AND IVe-5

Practices	Management level	
	A	B
Fertilization	No fertilizer.	In wet years, apply 100 pounds of ammonium sulfate per acre by airplane.
All other practices	Same as for group 1.	Same as for group 1.

[1] Dry-farmed small grains not recommended for soils of capability units not listed in this table.

TABLE 12.—*Irrigated pasture* [1]

GROUP 1: CAPABILITY UNITS IIw-3, IIs-7, IIIw-3, IIIs-3, AND IVs-3

Practices	Management level	
	A	B
Rotation	None.	Pasture 7 years, corn or small grain 2 years.
Soil preparation	Grade 0.125 to 2 percent.	Grade 0.25 percent.
Seedbed preparation	Roughly level; chisel, harrow.	Level precisely; chisel, harrow, seed, ringroll.
Fertilization	75 pounds superphosphate per acre.	300 pounds superphosphate per acre during February or March.
Seeding:		
Mixture	Ladino clover, hardingrass, dallisgrass, fescue, trefoil, and alfalfa.	Perennial ryegrass 3 pounds, annual ryegrass 3 pounds, ladino clover 3 pounds, and orchardgrass (Akaroa strain) 4 pounds.
Date	In fall or spring.	Nov. 1 to Dec. 1.
Irrigation:		
Method	Flood: checks ¼ to ½ mile long.	Flood: checks ⅛ to ¼ mile in length by 14 feet in width.
Frequency	After Mar. 15, at intervals of 7 to 10 days.	Begin when needed; about every 14 days, but vary as to temperature; after Apr. 30, at intervals of 7 to 10 days.
Total amount of water	54 inches.	42 inches.
Grazing	Livestock left in fields during irrigation; no rotation of grazing.	Livestock held off fields at least 3 days after irrigation; 25-day rotation with cross fencing, and stock to clean in 1 day.
Clippings	None.	2 per year.
Drainage	None.	Install drainage ditches to remove excess water; use pumps, if possible, to reuse runoff water.
GROUP 2: CAPABILITY UNITS I-1, IIe-1, AND IIw-2		
Irrigation	Checks ⅛ to ¼ mile long.	Flood: checks ⅛ mile long.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 3: CAPABILITY UNITS IIIw-4, IIIs-4, AND IVe-4		
Rotation	None.	[2].
Seedbed preparation	Same as for group 1, but harrow out bermudagrass.	[2].
Seeding mixture	Same as for group 1.	[2].
Irrigation:		
Method	Same as for group 1, except for checks ⅛ to ¼ mile long.	[2].
Total amount of water	More than 60 inches.	[2].
GROUP 4: CAPABILITY UNITS IIs-6 AND IIIw-6		
Fertilization	Same as for group 1, but add 500 pounds of gypsum per acre.	Same as for group 1, but add 4,000 pounds of gypsum per acre each year until alkali condition is corrected.
All other practices	Same as for group 1.	Same as for group 1.

See footnotes at end of table.

TABLE 12.—*Irrigated pasture* [1]—Continued

GROUP 5: CAPABILITY UNITS IIIw–5 AND IIIs–5

Practices	Management level	
	A	B
Grazing	Same as for group 1.	Do not irrigate until soil begins to dry in spring; do not graze until 5 days after irrigation or rain.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 6: CAPABILITY UNITS IIIe–1 AND IVe–3		
Irrigation	Same as for group 1.	Checks of as much as 440 feet; use small flow of water.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 7: CAPABILITY UNIT IIIs–8		
Fertilization	Same as for group 1.	Same as for group 1, but add 3 tons of gypsum per acre each year until alkali condition is corrected.
All other practices	Same as for group 1.	Same as for group 1.
GROUP 8: CAPABILITY UNIT IIIs 6 AND IVs–8		
Fertilization	Same as for group 1.	Same as for group 1, but add 5 tons of gypsum per acre each year (with heavy flooding) to correct alkali condition; also plant barley (Mariout variety) 1 year ahead of pasture seeding.
All other practices	Same as for group 1.	Same as for group 1.

[1] Irrigated pasture not recommended for soils of capability units not listed in this table.
[2] Irrigated pasture not recommended for soils of capability units IIIw–4, IIIs–4, and IVe–4 at the B level of management.

TABLE 13.—*Irrigated peaches* [1]

GROUP 1: CAPABILITY UNIT I–1

Practices	Management level	
	A	B
Pruning	Standard pruning by migrant workers with little supervision.	Selective pruning by year-round employees who may use mechanized equipment.
Soil preparation	Grade 0.1 to 0.2 percent.	Grade less than 0.1 percent.
Fertilization	100 pounds nitrogen per acre from October to March.	90 to 130 pounds of nitrogen per acre, depending on vigor of trees, from October to December.
Zinc spray	Not used.	At least once a year.
Cover crop	None.	May use cover crop, depending on need; may use permanent sod and shred prunings of trees.
Disease and insect control	Spray 4 times.	Spray 5 or 6 times, depending on climate during year and variety of peaches.
Cultivation	4 double diskings.	2 or 3 diskings or 2 or 3 shreddings, or a combination of these practices.
Irrigation:		
Method	Flood: checks 1,000 to 1,400 feet long.	Flood: checks 600 to 800 feet long; furrows on loams and clay loams.
Frequency	7 or 8 times.	6 times.
Amount of water	4 acre-feet per year.	3.5 acre-feet per year.
Drainage	None. Water may pond at end of checks.	Level soil so that, by timing irrigation runs, ponding does not occur.
Thinning	Standard thinning by migrant labor on May 15.	Selective thinning from mid-April to late May, depending on need.
Harvest	Labor receives little supervision.	Labor well supervised.

See footnote at end of table.

TABLE 13.—*Irrigated peaches* [1]—Continued

GROUP 2: CAPABILITY UNIT IIe–1

Practices	Management level A	Management level B
Irrigation method	Contour checks.	Contours furrows or sprinklers.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 3: CAPABILITY UNITS IIs–3 AND IIs–7

Practices	A	B
Irrigation:		
Method	Same as for group 1.	Same as for group 1, but use furrow irrigation on loams and clay loams.
Frequency	Same as for group 1.	7 or 8 times, 4 inches per irrigation.
Total amount of water	Same as for group 1.	30 to 36 inches.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 4: CAPABILITY UNITS IIIe–4 AND IIIs–4

Practices	A	B
Fertilization	Same as for group 1.	150 to 200 pounds of nitrogen per acre split in 3 applications and 2.5 tons manure per acre.
Irrigation	Grade 0.2 to 0.3 percent.	Same as group 3 but grade 0.2 percent; use sprinklers on slopes of more than 1 percent.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 5: CAPABILITY UNIT IVe–4

Practices	A	B
Fertilization	Same as for group 1.	Total of 150 to 200 pounds nitrogen per acre in 3 applications and 5 tons of manure per acre.
Irrigation:		
Method	Grade 0.2 to 0.3 percent; checks 440 to 660 feet long.	Sprinklers.
Frequency	7 or 8 times.	8 or 9 times.
Total amount of water	4 to 5 acre-feet.	3 to 3.5 acre-feet.
All other practices	Same as for group 1.	Same as for group 4.

[1] Irrigated peaches not recommended for soils of capability units not listed in this table.

TABLE 14.—*Dryland range* [1]

GROUP 1: CAPABILITY UNITS IIIe–1, IIIs–5, IVe–1, AND IVe–5

Practices	Management level A	Management level B
Reseeding	None.	Plant 10 pounds per acre of rose clover, bur-clover, or crimson clover if needed.
Fertilization	None.	200 pounds of ammonium sulfate.
Rotational grazing	None.	Rotate grazing twice a year; vary grazing period—graze a range early one year and late the next.

GROUP 2: CAPABILITY UNITS IVe–3, IVs–3, VIe–3, AND VIe–9

Practices	A	B
Reseeding	None.	Plant 10 pounds per acre of rose clover, burclover, or crimson clover if needed.
Fertilization	None.	400 pounds of ammonium sulfate per acre.
Rotational grazing	None.	Rotate grazing twice a year; vary grazing period—graze a range early one year and late the next.

See footnote at end of table.

TABLE 14.—*Dryland range* [1]—Continued

GROUP 3: CAPABILITY UNITS VIIe–3 AND VIIe–9

Practices	Management level	
	A	B
Reseeding	None.	None.
Fertilization	None.	None.
Rotational grazing	None.	Rotate grazing twice a year; vary grazing period—graze a range early one year and late the next.
GROUP 4: CAPABILITY UNITS IIw–2, IIs 6, IIIs–8, AND IVw–6		
Reseeding	None.	None.
Fertilization	None.	200 pounds of ammonium sulfate per acre.
Rotational grazing	None.	Rotate grazing twice a year; vary grazing period—graze a range early one year and late the next.

[1] Soils of capability units not listed in this table generally are not used for dryland range.

TABLE 15.—*Irrigated walnuts* [1]

GROUP 1: CAPABILITY UNIT I–1

Practices	Management level	
	A	B
Pruning	None.	Prune annually; make one large cut and several small cuts to remove cross limbs.
Soil preparation	Grade 0.1 to 0.2 percent.	Grade less than 0.1 percent.
Fertilization	50 to 75 pounds of nitrogen per acre; zinc not used.	Apply 100 to 175 pounds of nitrogen per acre, depending on vigor; pound zinc points in trunks of trees where necessary.
Cultivation	Disk 2 to 5 times and smooth for harvest.	Disk 2 or 3 times and smooth and roll for harvest.
Cover crop	None.	Plant 40 to 60 pounds of winter rye and apply 50 pounds of nitrogen per acre in November.
Spraying	1 time.	3 or 4 times, depending on variety of walnut.
Irrigation:		
Method	Flood: checks 1,000 to 1,400 feet long.	Flood: checks 600 to 800 feet long.
Frequency	2 to 4 times.	5 times.
Total amount of water	2 or 3 feet.	3.5 feet.
Drainage	None (water ponds at end of checks).	Level sod so that, by timing irrigation runs, ponding does not occur.
Harvest	Hand pickup with little supervision.	Mechanically knocked and picked up and immediately taken to huller.
GROUP 2: CAPABILITY UNIT IIe–1		
Irrigation	Contour checks.	Contour furrows or sprinklers.
All other practices	Same as for group I–1.	Same as for group 1.
GROUP 3: CAPABILITY UNIT IIw–2		
Drainage	None.	Install drainage ditches, where needed, to keep water table at depth of more than 8 feet.
All other practices	Same as for group 1.	Same as for group 1.

See footnote at end of table.

TABLE 15.—*Irrigated walnuts* [1]—Continued

GROUP 4: CAPABILITY UNITS IIIe-4 AND IIIs-4

Practices	Management level	
	A	B
Fertilization	Same as for group 1.	Total of 150 to 200 pounds of nitrogen per acre split in 3 applications.
Irrigation	Grade 0.2 to 0.3 percent.	Grade 0.1 to 0.2 percent; use sprinklers on slopes of more than 1 percent.
Frequency	2 to 4 times.	6 times, 4 or 5 inches of water per irrigation.
All other practices	Same as for group 1.	Same as for group 1.

GROUP 5: CAPABILITY UNITS IIs-3 AND IIs-7

Practices	A	B
Irrigation:		
Method	Same as for group 1.	Flood (use furrows on loams and clay loams).
Frequency	Same as for group 1.	6 times, 4 inches of water per irrigation.

GROUP 6: CAPABILITY UNIT IVe-4

Practices	A	B
Fertilization	Same as for group 1.	Total of 150 to 250 pounds of nitrogen per acre split in 3 applications.
Irrigation	Grade 0.2 to 0.3 percent.	Sprinklers, 4 inches of water per irrigation; 7 or 8 applications; total of 3 to 3.5 feet of water.

[1] Irrigated walnuts not recommended for soils of capability units not listed in this table.

Formation and Classification of Soils

In this section the factors that influenced soil formation are discussed and the soils are classified in higher categories.

Soil Formation

The properties of a soil depend upon the primary soil-forming factors: climate, parent material, relief, living organisms, and time (*9*, *10*). Each kind of soil is the result of a different combination of the soil-forming factors. Each factor is here discussed in relation to its influence on soil formation in the Area.

Climate

The present climate does not vary greatly across the Area. The summers are very dry. The skies are virtually cloudless, and the days are warm to hot. The winters are cool and have moderate amounts of rainfall, some fog, and occasional frost. Average annual rainfall increases gradually from west to east, from about 10 inches along the San Joaquin River to 18 inches at the edge of the Sierra Nevada foothills (see fig. 25). Most of the rainfall occurs from December to March, inclusive. During this time the loss of soil moisture by evaporation and plant transpiration (evapotranspiration) is small, and the rain therefore wets the soil very effectively. More information on climate is given in the section "General Nature of the Area."

At the western edge of the Area, the rainfall, after loss by evapotranspiration, is sufficient to wet most of the soils only to their water-holding capacity. There is little or no excess to leach the soil to depths beyond the reach of roots (see fig. 27). In the eastern part of the Area, more rain falls during the rainy period than the soil can hold or the plants can use. The surplus moisture moves down through the soils, and they tend to become increasingly leached.

Temperatures rise rapidly in the spring, and vegetation grows rapidly for a short period. The available soil moisture, however, is soon exhausted, and the grassland vegetation matures and turns brown, usually in May. The amount of vegetation produced is not large, and decomposition is rapid because of the warm to hot weather that occurs late in spring and during the long summer. Consequently, most of the soils are low in organic matter (humus) content. Only soils in especially moist areas contain much organic matter.

Where soils have a high water table, surface evaporation during the long, warm summers contributes greatly to the upward capillary movement of water. As a result, salts have accumulated in the soil in the western part of the Area.

Parent material

The geology and geomorphic history of the Area help to explain the distribution of soil parent materials as well as to provide some clues as to the age of the soils.

The geology of the Eastern Stanislaus Area is largely a reflection of the geologic history of the Sierra Nevada. The Area is made up mainly of sediments derived from the mountains. The complexity of the geology of the Area is shown by figure 19.

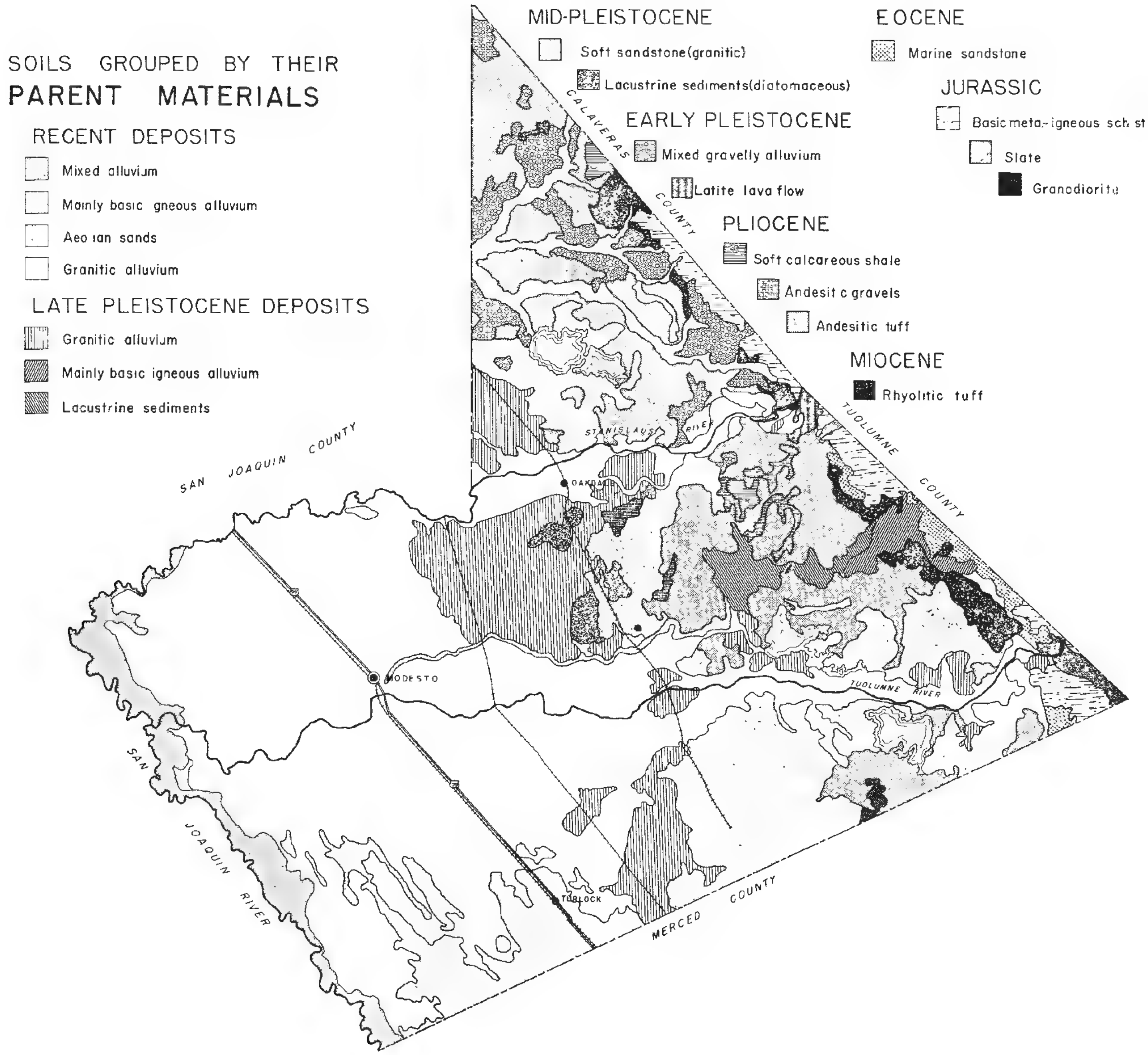

Figure 19.—**Soils grouped by parent materials.**

The oldest rocks are greenstone schist, slate, and granodiorite. They occur in a narrow band along the eastern edge of the Area. Adjacent to these hard rocks are a few patches of Ione sandstone (*2*), which are relicts of the shoreline of an ocean that existed here about 40 million years ago. Later, following the westward retreat of this ocean, younger deposits were washed into the valley during a period of volcanic activity in the mountains, some 8 to 20 million years ago (*8*). The base of these deposits is exposed just west of the Ione sandstone and is made up of rhyolitic (acid) tuff. The upper part consists of andesitic (basic) tuff and beds of andesitic gravel exposed in a band about 10 miles wide along the eastern side of the Area. All of these rocks are more or less consolidated and give rise to shallow soils that have frequent exposures of bare rock.

Following the period of volcanic action, there were two long periods of stability, each followed by major uplift of the mountains accompanied by lesser uplift along the eastern side of the valley. Broad plains mantled with gravel formed during each period of stability. Each period of uplift started a cycle of erosion that cut away parts of the plains. Remnants of the gravel mantles remain as gravelly cappings on hilltops and high terraces. Toward the end of the first erosional period, there was a volcanic

eruption in the mountains that produced a flow of latite lava. This lava flow followed an ancient river channel down to the valley. Its western end forms a rocky area southeast of Knights Ferry known as Tuolumne Table Mountain.

During the past million years, large quantities of granitic rock were ground up during a series of glacial periods in the high mountains and were washed into the valley. The sequence of glacial and interglacial periods is reflected by a series of alluvial fans in the valley. These fans consist of old granitic alluvium, moderately old granitic alluvium, and young granitic alluvium. The old granitic alluvium in the vicinity of Woodward Reservoir, Modesto Reservoir, and Turlock Lake has been partially eroded into rolling and hilly topography.

A deposit of diatomaceous sediment is in the area between Waterford and Oakdale. The diatoms have been identified tentatively as *Stephanodiscus*, a fresh water type that indicates the former existence of a large lake in that area.

Recent alluvium occurs only along the present river bottoms and in small fans in the trough of the valley. These areas receive additions of new material with occasional floods. The rivers and their flood plains are entrenched across the fans between sharply defined escarpments. This suggests that the rivers have cut their way down to their present level relatively recently.

The characteristics of parent rock that influence soil formation most directly are (1) hardness, grain size, and porosity and (2) content of weatherable material. The rocks of the Sierra Nevada foothills are hard and of low porosity. Consequently, they disintegrate and decompose into soil material very slowly. Natural erosion processes tend to remove the soil about as fast as it forms; therefore the soils in that area (Exchequer, Auburn, Whiterock, Amador, and Toomes) are shallow except on the gentlest slopes (fig. 20). The Ione sandstone contains only a little weatherable mineral and is fairly hard. The soils of the Hornitos series, which have formed from it, are shallow, infertile, and sandy because of their high content of quartz. The andesitic tuff, on the other hand, although moderately consolidated, contains much weatherable mineral and is fairly porous. Consequently, it decomposes rapidly into clay and gives rise to the Peters and Raynor clays.

The gravel beds mantling the older, high terraces contain quantities of hard pebbles and cobbles, which tend to reduce the water-holding capacity of the soils. As a result, soils such as Corning and Redding are leached, acid, and infertile.

The deposits of granitic sediment laid down during the glacial epoch are unconsolidated or only weakly consolidated and contain much quartz sand. Consequently, the soils formed tend to be moderately deep to deep and are mainly sandy loams. They have a moderate water-holding capacity. The older soils are partially leached, slightly acid, and somewhat infertile.

Alluvium deposited by minor streams, such as Dry Creek, is unconsolidated and contains much weatherable mineral. Consequently, the soils developed from this alluvium are deep and medium to moderately fine textured and are mainly silt loams and clay loams. They have a high water-holding capacity, are generally fertile, and are slightly acid only in the surface horizon.

Relief and drainage

Relief and the accompanying differences in drainage are responsible for many differences in soils in the Area. The physiography of the Area east of the Santa Fe Railroad is shown in figure 21; that of the entire Area is shown in figure 2.

The Eastern Stanislaus Area lies within the great interior valley of California. This valley is about 400 miles long; the northern half is drained by the Sacramento River flowing south; the southern half, by the San Joaquin River flowing north. The two rivers merge near Sacramento and empty into the San Francisco Bay. The surveyed area is near the northern end of the San Joaquin Valley, between the San Joaquin River and the foothills of the Sierra Nevada on the east.

The entire Eastern Stanislaus Area is within the drainage basin of the San Joaquin River. Three major tributaries of the San Joaquin River, rising high in the Sierra Nevada, flow westward across the Area. The Tuolumne

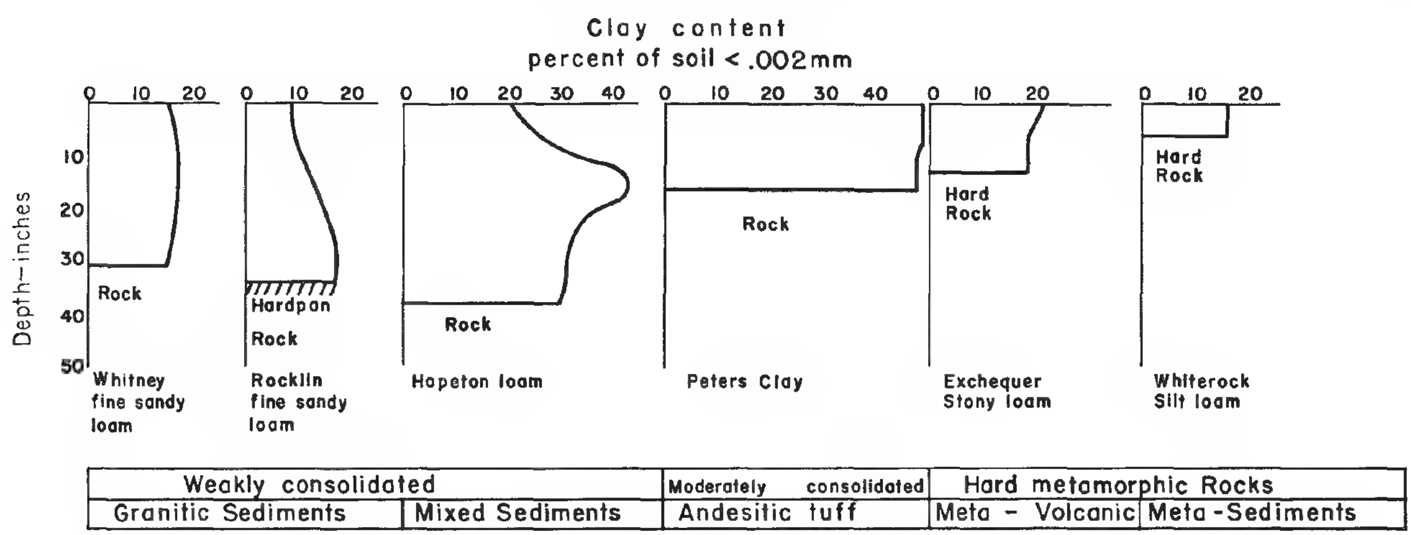

Figure 20.—Relationships between clay content of several soils and the kind of parent materials from which they have formed.

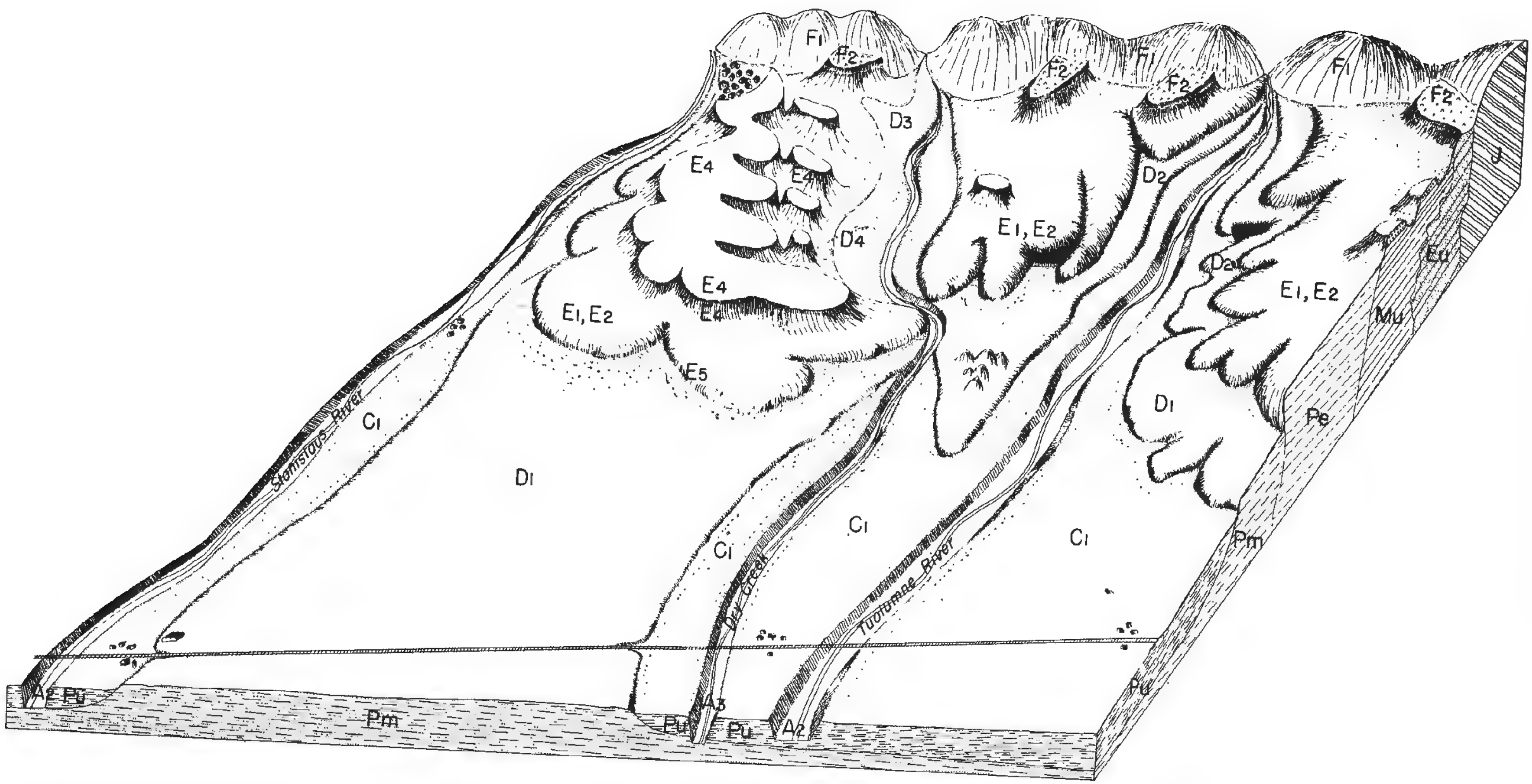

Figure 21.—Diagram, looking east, of Eastern Stanislaus Area east of the Santa Fe Railroad. A, Recent alluvial floodplains: A2, Alluvial soils, granitic; A3, Alluvial soils, mainly basic igneous. C, Young alluvial fans: C1, Alluvial soils, granitic. D, Low alluvial terraces and moderately old fans: D1, Cemented hardpan soils, granitic; D2, moderately developed soils, granitic; D3, moderately developed soils, mainly basic igneous; D4, clay soils, lacustrine sediments. E, High alluvial terraces, partly eroded to rolling hills: E1, E2, Weakly to strongly developed soils, granitic; E4, weakly to strongly developed soils, andesitic. F, Upland soils of the Sierra Nevada foothills: F1, Shallow soils, metamorphic rocks; F2, shallow soils, marine sediments. Lava flow shown by symbols. Geologic formations are Pu, Modesto; Pm, Riverbank; Pe, Turlock Lake; Mu, Mehrten; Eu, Ione; and J, Logtown Ridge and Mariposa.

River is in the southern part, the Stanislaus River is farther north, and the Calaveras River flows across the northernmost tip. In addition, there are minor streams rising in the foothills east of the Area. The largest is Dry Creek, which drains an area between the Tuolumne and Stanislaus Rivers and joins the Tuolumne River at Modesto. The physiographic areas described in the following paragraphs are shown in figure 2.

Along the San Joaquin River, in the trough of the valley, there is a nearly level flood plain, 1 to 2 miles wide. It is traversed by channels and, except where protected by levees, is subject to occasional flooding. Similar but somewhat narrower flood plains follow the Tuolumne and Stanislaus Rivers and minor streams.

The soils of the flood plains vary according to the intensity and duration of flooding; the rate of deposition of alluvial material; the duration of high water table, which is controlled by the level of water in the stream; and differences in relief.

In the eastern part of the Area, the floods and the high water table are of short duration and the alluvium is deposited fairly rapidly. The soils show little or no profile development, although they may be stratified; and they are generally well drained, noncalcareous, and unmottled. The principal soils are in the Hanford, Honcut, and Tujunga series.

Along the San Joaquin River and the lower reaches of the Stanislaus and Tuolumne Rivers, the floods last somewhat longer than upstream, and the high water table may persist for several months in the latter part of spring and in summer. As a result, the soils are imperfectly to poorly drained, mottled and, in part, calcareous or saline. The noncalcareous Columbia soils occur on the San Joaquin flood plain, and the calcareous Grangeville soils occur along the Stanislaus and Tuolumne Rivers. The dark-colored, very poorly drained, mottled Foster soils occur in depressions and oxbows. The dark-colored, moderately fine and fine textured, calcareous Temple soils occur in slack-water areas where deposition of alluvium is slow.

East of the San Joaquin River flood plain is a nearly level basin, 2 to 4 miles wide and 35 to 50 feet above sea level. The basin is characterized by very slow runoff, a generally high water table, and scattered mound microrelief where the soil has not been leveled (*4*). In areas of the basin where there is very slow runoff and a permanent high water table, the upward moisture movement has caused an accumulation of salts in the soils. The principal soils in these areas are the Traver and Waukena, which have a prismatic or columnar subsoil, and the Fresno, which have a cemented hardpan. In areas without external drainage, the fine-textured, dark-colored Rossi are the dominant soils. In areas of mound microrelief, the Rossi and Waukena soils form a complex—the Waukena soils on the mounds, and the Rossi soils in the intervening depressions.

Diagrams of several soil profiles are shown in figure 22. These profiles show the relationship of clay content, pH, and depth of water table. In Dinuba sandy loam, the depth to the water table varies 1 foot or more. In Hanford sandy loam, it is greater than 6 feet.

Farther east is a smooth plain, 10 to 15 miles wide and 50 to 120 feet above sea level. It slopes very gently westward. This plain is made up of confluent young alluvial fans of the Stanislaus and Tuolumne Rivers. Toward the south it has been modified by wind erosion; as a result, the relief is gently undulating.

The part of this plain lying west of the Southern Pacific Railroad is affected by a high water table. The depth to the water table ranges from 3 to 6 feet. Consequently, the soils are generally imperfectly drained, faintly mottled, calcareous in the subsoil, and locally weakly saline. The dominant soils are the Dinuba and Hilmar. The well-drained soils of the Hanford and Tujunga series occur only on abandoned stream ridges, which are from 2 to 4 feet higher than the general surface. The Delhi soils are only on ridges of wind-deposited sand. There are a few scattered depressions where the water table is close to the surface and the soils are dark colored and prominently mottled.

The eastern part of the plain is generally unaffected by a high water table, and the soils, as the Hanford and Greenfield, are generally unmottled and noncalcareous. North of Modesto, however, there is an interfan area where runoff is very slow. As a result of the extra moisture in this area, the Modesto and Chualar soils are darker and contain more clay than the surrounding Hanford soils.

At the time that the young alluvial fans were deposited, a number of minor drainageways, as well as Dry Creek, were choked by alluvium. Ponds and, in Paulsell Valley, a lake or swamp were formed. Fine material was deposited in these ponded areas and dark-colored clays formed. The Paulsell Valley has been drained by stream entrenchment, and it is no longer ponded.

Between the young alluvial fans and the Sierra Nevada foothills to the east is an area of older alluvial fans and terraces. At its eastern edge, this area reaches an elevation of about 600 feet above sea level. Toward the west are gently undulating, moderately old fans that are 6 to 8 miles wide and 130 to 200 feet in elevation. The soils of these fans have distinct B horizons (Snelling series) and hardpans (San Joaquin and Madera series) in some places. Runoff on the gently undulating relief provides adequate drainage, but it has not been rapid enough to affect soil development. Soils are generally brown or reddish brown, are without mottling, and have a medium-textured surface horizon. In small areas without external drainage, where extra moisture has hastened clay formation, the gray Alamo clay has developed.

Farther east, and in the north, natural erosion has partially destroyed the older, higher fans and terraces and has left gently sloping, high terrace remnants and intervening rolling hills and minor drainageways. There the effect of relief on soil development is very marked. On the gently sloping, high terrace remnants, the soils have not been affected by erosion and have distinct horizons. Such soils are the Montpellier, Redding, and Keyes. On the rolling hills, erosion has reduced soil depth and has restricted profile development, as in the Pentz, Peters, and Whitney soils. In swales and foot slopes receiving extra moisture, soil development has been fairly rapid. There the Hopeton and Raynor soils, which contain much clay, have developed. In places various combinations of slope, moisture conditions, and erosion rate have produced a com-

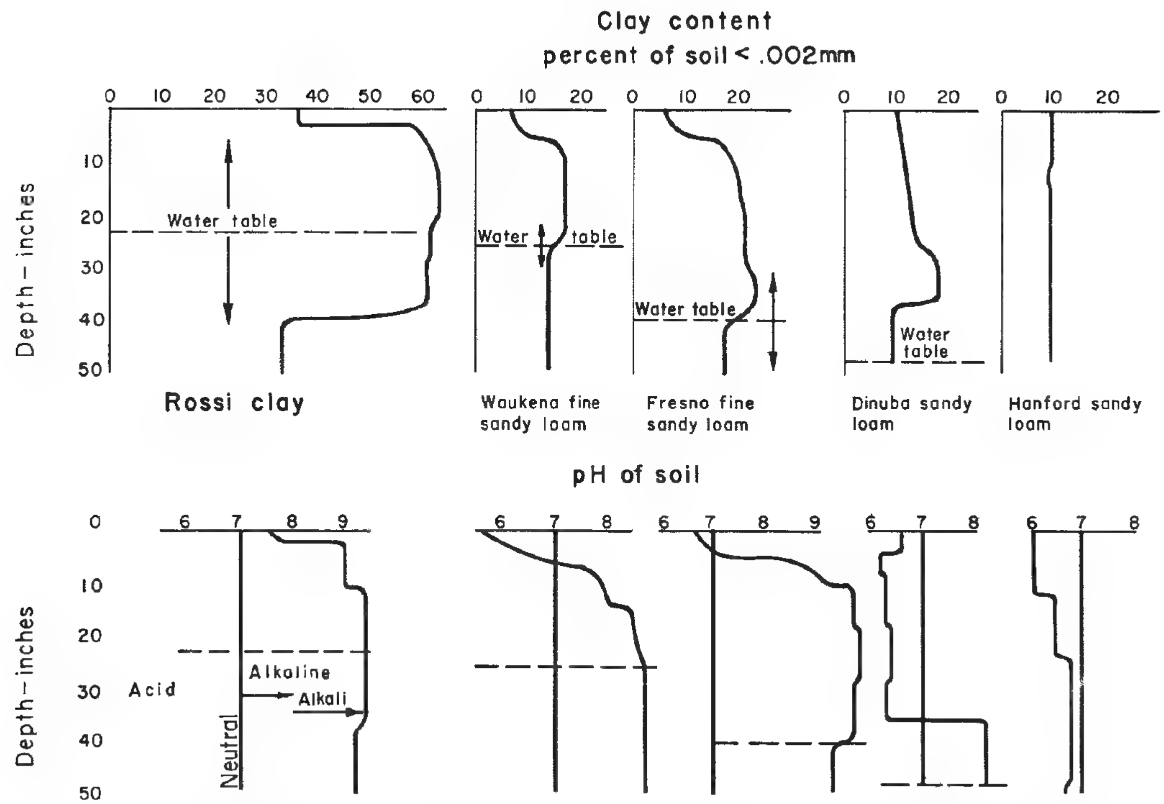

Figure 22.—**Relationship of clay content, pH (acidity or alkalinity), and depth of water table.**

plex pattern of soils, such as that of the Whitney and Rocklin sandy loams. In undisturbed areas of gentle relief, mound microrelief is a conspicuous feature of the landscape. Characteristic of this relief are dome-shaped mounds, 2 to 5 feet high and 30 to 100 feet across, and intervening oval depressions. The mounds are thought to be the work of pocket gophers (*4*). Soil horizons are generally thicker and textures somewhat coarser in the mounds than in the intermounds (*12*).

The eastern edge of the Area includes a narrow band of the foothills of the Sierra Nevada. Relief is rolling to hilly, and there are numerous outcrops of hard rock. Elevations are as much as 871 feet; the highest point is on Cardoza Ridge, southeast of La Grange. In this area soils are mainly rocky and shallow to very shallow and have little or no profile development because of natural erosion. Steep areas are generally very shallow and hilly, and rolling areas are shallow. Some small areas have gentle slopes and are moderately deep in places.

Time

The age of the soils of the Area ranges from very young to more than a half million years. The oldest soils are those on the nearly level high terraces and old fans in the eastern part of the Area. The youngest soils are forming on the recently deposited alluvium along stream bottoms and on recently exposed surfaces, such as escarpments at the edges of the bottom lands.

The oldest soils have very distinct horizons; they usually have claypan or hardpan layers in the subsoil at depths of 2 feet or less. They are very slowly permeable to water and roots, acid in reaction, and low in fertility. They lack particularly nitrogen and phosphorus.

The soils on recently deposited alluvium are generally deep, permeable, and rich in mineral plant nutrients. They have no discernible horizons other than a little accumulation of organic matter in the surface layer.

The soils on the various terrace levels between the two extremes are at intermediate stages of profile development. In general, the higher the terrace level, the older, more strongly weathered, and less fertile the soil. Also, the soils on the sides of the terraces have been exposed to weathering for varying lengths of time that are difficult to determine. The same is true of the soils in the foothills of the Sierra Nevada.

The oldest land surfaces are estimated to be of early Pleistocene and late Pliocene age. This estimation is based on the relationship of these areas to the Tuolumne Table Mountain lava, which according to geologists is of Pliocene age.[4] The age of the sandy alluvial fans spans the interval during which the glaciers were active in the Sierra Nevada. The alluvial flood plains were deposited in the trenches cut by the major streams after the deposition of the most recent major fan.

[4] SOLARI, A. J. THE TERTIARY FORMATION OF THE COPPEROPOLIS QUADRANGLE. 1935. (Master's thesis submitted to Dept. of Geology, Univ. Calif.)

The following approximate time scale is based on geomorphic and geologic studies.

Approximate number of years ago:	*Land surface*	*Typical soil series*
0 to 1,000	Alluvial flood plains of granitic material.	Columbia, Temple, Grangeville.
1,000 to 10,000	Young fans and basins of granitic material.	Hanford, Greenfield, Dinuba, Fresno.
10,000 to 140,000.	Moderately old alluvial fans and terraces of granitic material.	Snelling, Madera, San Joaquin.
140,000 to 650,000.	Old alluvial fans of granitic material.	Montpellier,[1] Rocklin.
650,000+	Very old, high fans of gravelly material.	Corning, Redding, Keyes.

[1] Recently a thin bed of pumice within the material from which the Montpellier soil formed has been dated by the Potassium-Argon method as 600,000 years old ±3.3 percent. (Personal communication from G. B. Dalrymple, Dept. of Geology and Geophysics, University of California, Berkeley.)

As soils increase in age, the soil-forming processes produce changes which are of great importance to agriculture. Intensive agriculture is carried on almost exclusively on young soils in the Eastern Stanislaus Area, and the older soils are used mainly for grazing, irrigated pasture, or extensive dry-farmed crops. In well-drained areas, the changes produced by soil-forming processes include (1) the leaching of bases, such as calcium, magnesium, sodium, and potassium, from the upper part of the soil and the accompanying increases in acidity; (2) the formation of clay and its accumulation in the subsoil to form textural B horizons; (3) an increase in the phosphate-fixing power and consequent decrease in available phosphate in the soils; and (4) the cementation of subsoil layers to form impermeable hardpans.

Some of these changes are illustrated in figure 23. As shown in this figure, the acidity increases from very slightly acid (pH 6.5 to 6.8) in the surface soil of the Hanford and Greenfield soils, to slightly acid (pH 6.3 and 6.4) in that of the Snelling and Montpellier, to medium acid (pH 5.6) in that of the San Joaquin soil, and to strongly acid in that of the very old Redding soil. The pH in Hanford sandy loam was probably reduced by use of acidic nitrogeneous fertilizers. Soil fertility tests also show that Hanford and Greenfield soils are adequately supplied with available phosphate, that the Snelling are slightly deficient, but that the Monpellier, San Joaquin, and Redding are markedly deficient. Likewise, the content of clay in the B horizon increases with time. Considering thickness, as well as amount per unit volume, the total clay content of the Montpellier soils appears to be greater than that of the Redding (see figure 23), but there may be considerable clay in the cemented horizon of the Redding.

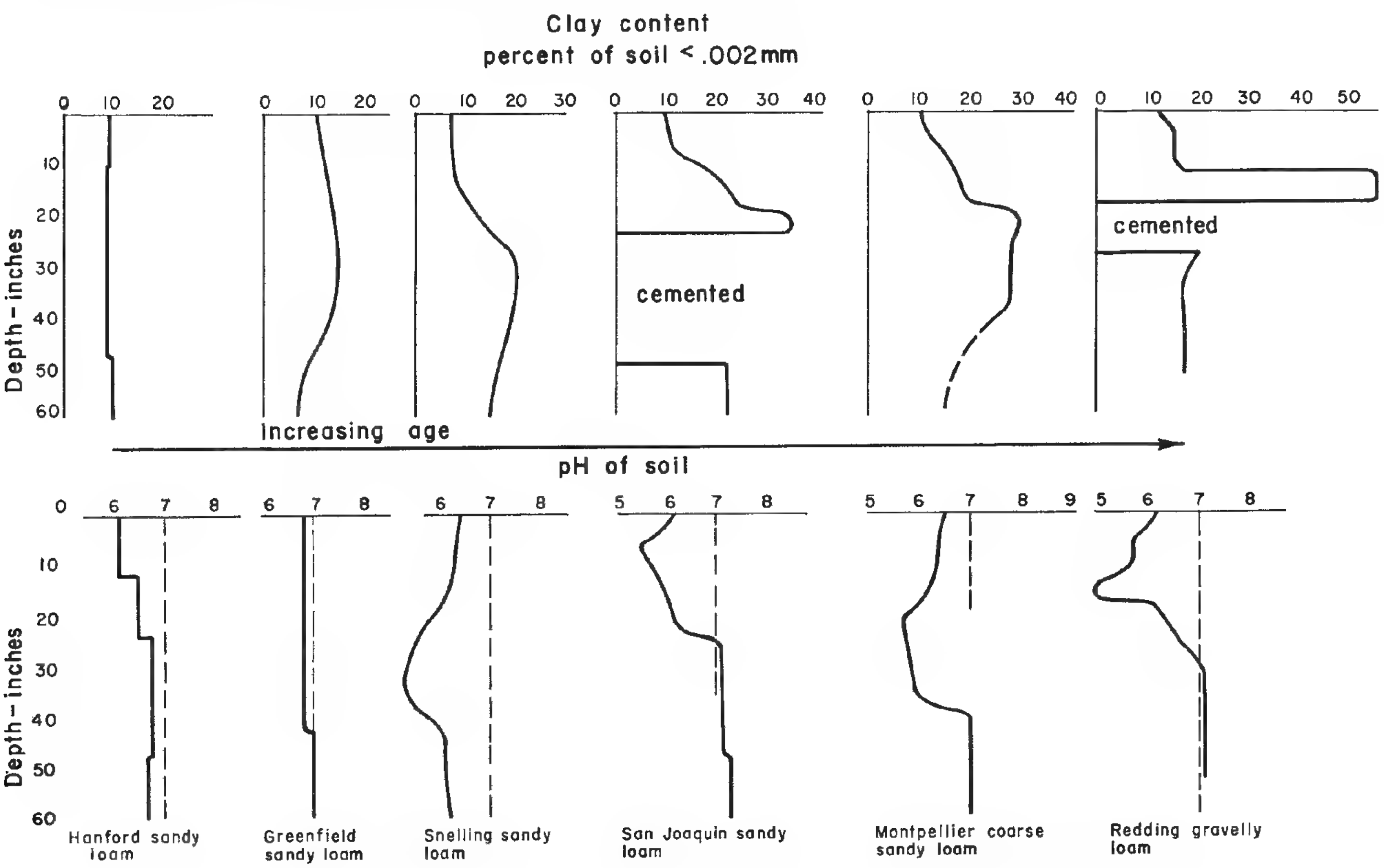

Figure 23.—Relationship of age of the soils to clay content and reaction (pH).

Color is another feature of the sequence in soil development. For example, the younger soils have a brown B horizon, whereas the older soils have a reddish brown or red B horizon. This indicates an increase in iron oxide, as well as in clay content, with age.

The cemented hardpans in the older soils have long been of interest to soil scientists, as well as of great concern to farmers, because they effectively stop the penetration of roots and water at relatively shallow depths. These hardpans are cemented with silica and iron and are exceedingly dense. They occur in a number of old soils in California. In Stanislaus County the soils with hardpans are the Madera and San Joaquin soils formed from sandy loam alluvium, the Yokohl from silt loam alluvium, and the Redding and Keyes from gravelly alluvium. The Montpellier soils, however, which are at least as old if not older than the San Joaquin and Madera soils, have no cemented hardpan layer but do have vertical seams where the cement is deposited. The Montpellier soils have formed from coarse sandy loam alluvium and must have been very porous and permeable in their early stages of development. These factors in the development of these soils may account for the fact that cementing material has not accumulated in a definite hardpan layer.

It appears that the sequence of development for a uniform alluvial deposit of medium-textured materials is about as follows. The surface layer accumulates a little organic humus, and a faint A1 horizon is formed. In the next stage, the soil shows a very slight tendency toward acidity in the surface soil and a faintly discernible textural B horizon. Then the surface soil becomes slightly acid, a distinct textural B horizon is evident, and phosphate deficiencies occur. Finally, the soils become strongly acid and have marked phosphate deficiencies. Furthermore, they have pronounced textural B horizons, and all the soils, except those with the most porous parent materials, have cemented hardpans.

Another kind of sequence in soil development is observed in soils that have a high content of weatherable minerals of high base content in the parent material. This sequence is illustrated by the soils that formed from bluish-gray andesitic tuff (fig. 24). The first soil to form from this kind of material is Pentz stony loam, which is only a few inches deep and has no textural horizons. As time goes on, this soil changes rapidly to Pentz loam, and then to Pentz clay loam. There is only a slight increase in depth but a distinct increase in clay content. No textural horizons develop. This lack of development is attributed to the highly weatherable nature of the material; clay is apparently formed in the soil faster than it is moved downward by percolating rainwater.

The next stage is Peters clay, which is a little deeper (up to 18 inches deep). Wide cracks form when the soil dries, and there is evidence of self-mixing caused by the falling of surface material into the cracks. The oldest soil of this group, the Raynor soil, is of clay texture to a depth of 30 to 50 inches and has a little lime in the lower part. The presence of slickensides and straw in cracks to

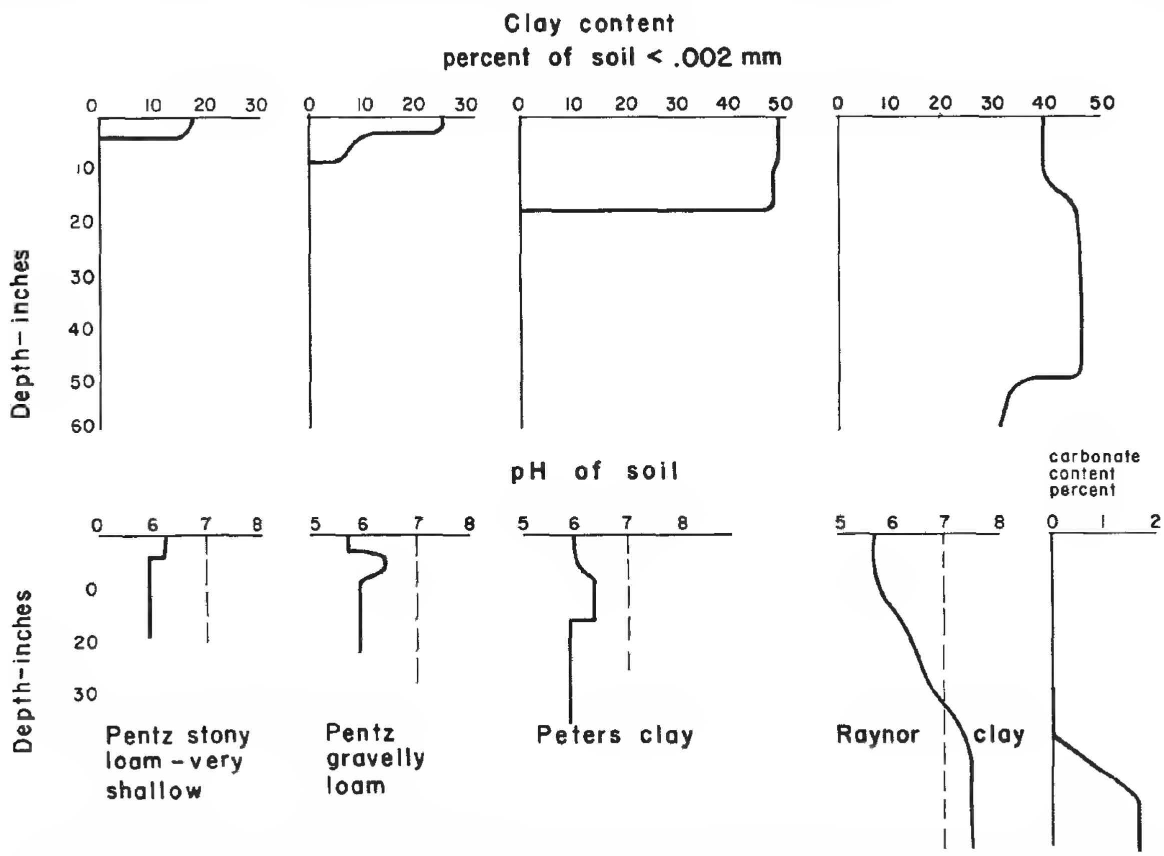

Figure 24.—Age of soils formed from readily weatherable andesitic tuff in relation to clay content, reaction (pH), and carbonate content.

a depth of 24 inches or more is a good evidence of self-mixing. At this stage, the rate of soil change is slow because of the mixing action and the high water-holding capacity of the clay. The soil is wet to its full depth only in wet years.

Living organisms

The vegetation of the Eastern Stanislaus Area is mainly annual grasses and forbs. Some perennial grasses, however, grow in moist places, and scattered oaks grow on the deeper soils. The amount of organic matter is low, typically less than 1 percent, because of the short period of favorable moisture and temperature and the rapid decomposition of plant remains during the long, dry, warm summers. Only along streams and in low areas that are unusually moist is there enough vegetation to produce a large amount of organic matter in the soils. In these areas the soils are dark in color; in most of the better drained areas, however, the soils are light in color.

Except for burrowing rodents, animals have caused few differences in the soils. Pocket gophers are especially active in disturbing soil-forming processes. The mound microrelief, known locally as hogwallows, has been attributed to gopher activity (*4*). Where soils are shallow over a hardpan or claypan, or where the water table is high, the gophers build mounds to make more favorable sites for nesting and burrowing. Thus the depth of the soil and the thickness of the horizons are altered over short distances.

Classification of Soils

In the key to the soils of Eastern Stanislaus Area, the soil series of the Area are arranged according to drainage, character of the parent material, degree of profile development, and great soil group (see pages 128 and 129). The soil series are classified by great soil groups as proposed in 1938 (*7*) and modified in 1949 (*16*) and in 1950 (*11*).

The well-drained to excessively drained soils formed from consolidated parent material include Lithosols, Grumusols, Noncalcic Brown soils, and Grumusols that have some characteristics of Brunizems.

Lithosols are shallow, generally rocky, soils without textural B horizons; they occur in upland areas where erosion has retarded soil development. Five relatively light-colored soils, the Amador, Exchequer, Hornitos, Toomes, and Whiterock, are included in this group. The Toomes soils are medium to slightly acid, the Exchequer and Whiterock soils are slightly acid, and the Hornitos and Amador soils are medium to strongly acid. The related Pentz soils are grayish brown and have a fair amount of organic matter—features associated with Brunizems. Accordingly, the Pentz soils are Lithosols intergrading to Brunizems.

Grumusols are dark-colored, fine-textured (clay) soils. Because of a high content of montmorillonitic clay, these soils form wide cracks and granulate on the surface on drying. Granular material falls down the cracks, and the consequent soil mixing prevents the formation of distinct horizons. Included in this group are the Zaca and Raynor soils. The Zaca soils are shallow to moderately deep. Having formed from calcareous shale, they are calcareous throughout. The Raynor soils are moderately deep to deep. These soils formed from andesitic tuff and are calcareous only in the subsoil. The Peters soils are similar to the Raynor, but they are shallow and noncalcareous. As the properties of Grumusols are only weakly expressed in these soils, they are classed as Grumusols intergrading to Brunizems.

Noncalcic Brown soils have an A horizon that is brown, low in organic matter, hard and nearly massive when dry, and slightly acid to neutral in reaction. The pH increases with depth to neutral or mildly alkaline. These soils have a textural B horizon. The older soils have a cemented hardpan layer below the B horizon. Included in this group are the Whitney, Hopeton, and Rocklin soils. The Whitney soils occur on undulating to steep topography where erosion has retarded profile development. They have therefore only a weak textural B horizon. The Rocklin soils occur on gently undulating to undulating topography. These soils have a distinct textural B horizon that rests on a thin, cemented hardpan. The hardpan formed in the underlying weakly consolidated sediments. The Hopeton soils have pronounced textural B horizons formed from weakly consolidated sediments rich in weatherable minerals derived from mixed rock sources. The Auburn soils are reddish brown to yellowish red; they are more porous than typical Noncalcic Brown soils and are classed as Noncalcic Brown soils intergrading to Reddish-Brown Lateritic soils.

The moderately well drained to excessively drained soils formed from unconsolidated parent material include Noncalcic Brown soils, Alluvial soils, and Regosols.

The Noncalcic Brown soils with a weak textural B horizon have formed on young fans where a pronounced profile has not had time to develop. They include the Greenfield, Oakdale, and Wyman soils, as well as the imperfectly drained to moderately well drained Dinuba soils. The Dinuba soils have been slightly affected by a high water table and are weakly calcareous. They have a mottled B horizon, which rests on a silty substratum.

Noncalcic Brown soils with a distinct textural B horizon are on older fans and terraces of Pleistocene age. These are the Snelling, Chualar, Ryer, and Modesto soils. Noncalcic Brown soils with very pronounced textural B horizons are on very old fans and terraces and have an abrupt boundary between the A and B horizons. These are the Montpellier and Corning soils. The hue in the B horizon of these soils is 2.5YR to 5YR. The pH of the Montpellier soils decreases with depth.

Noncalcic Brown soils with pronounced textural B horizons that rest on a cemented hardpan are on the older fans and terraces. These are the Madera, San Joaquin, and Yokohl soils. The Redding and Keyes, also Noncalcic Brown soils, have similar profiles. They are on high, very old remnants of fans and terraces and are gravelly or cobbly. The Redding soil is more acid than the other soils in this group. The B horizon of this soil is strongly acid and has a hue of 2.5YR.

The Alluvial soils and Regosols do not have distinct horizons. They are uniform or stratified throughout their depth. The Alluvial soils associated with weakly developed Noncalcic Brown soils include Hanford, Honcut, Anderson, and Tujunga. The Tujunga soils are generally markedly stratified. The Delhi soils are Regosols made up of wind-deposited sand of granitic origin and

KEY TO SOILS OF EASTERN STANISLAUS AREA

WELL-DRAINED TO EXCESSIVELY DRAINED SOILS FROM CONSOLIDATED PARENT MATERIAL

Soils without a textural B horizon			Soils with a textural B horizon				
Great soil group	Parent material	Soil series	Great soil group	Parent material	Series, weak textural B horizon	Series, distinct textural B horizon	Series, cemented hardpan
Lithosols	Sandstone	Hornitos.	Noncalcic Brown soils.	Weakly consolidated granitic sediments.	Whitney	---	Rocklin
	Rhyolitic tuff	Amador.					
	Latite lava	Toomes.					
	Greenstone schist.	Exchequer.		Weakly consolidated mixed sediments.	---	Hopeton	---
	Slate	Whiterock.					
Lithosols intergrading to Brunizems.	Andesitic tuff	Pentz.	Noncalcic Brown soils intergrading to Reddish-Brown Lateritic.	Greenstone schist	Auburn	---	---
Grumusols	Calcareous shale	Zaca.					
	Andesitic tuff	Raynor.					
Grumusols intergrading to Brunizems.	Andesitic tuff	Peters.					

MODERATELY WELL DRAINED TO EXCESSIVELY DRAINED SOILS FROM UNCONSOLIDATED PARENT MATERIAL

Soils without a textural B horizon			Soils with a textural B horizon				
Great soil group	Parent material	Soil series	Great soil group	Parent material	Series, weak textural B horizon	Series, distinct textural B horizon	Series, cemented hardpan
Alluvial soils	Granitic alluvium.	Hanford.	Noncalcic Brown soils.	Granitic alluvium.	Greenfield	Snelling	Madera.
					Oakdale	Chualar	San Joaquin.
	Basic igneous alluvium.	Honcut.			Dinuba (imperfectly drained).	Montpellier	---
	Mixed gravelly alluvium.	Anderson.		Basic igneous alluvium.	Wyman	Ryer	Yokohl
	Coarse-textured granitic alluvium.	Tujunga.		Mixed gravelly alluvium.	---	Corning	Redding.
Regosols	Wind-deposited sand.	Delhi.		Mixed alluvium	---	Modesto	---
				Andesitic gravel	---	---	Keyes

IMPERFECTLY DRAINED SOILS FROM UNCONSOLIDATED PARENT MATERIAL

Soils without a textural B horizon			Soils with a textural B horizon				
Great soil group	Parent material	Soil series	Great soil group	Parent material	Series, weak textural B horizon	Series, distinct textural B horizon	Series, cemented hardpan
Alluvial soils------------	Mixed alluvium---	Columbia.	Noncalcic Brown soils intergrading to Humic Gley	Mixed alluvium----	-------------	Bear Creek--	-----------
Regosols------------------	Wind-deposited sand.	Hilmar					
Grumusols-----------------	Basic igneous alluvium.	Paulsell.	Humic Gley soils intergrading to Planosols	Granitic alluvium.	-------------	Meikle------	Alamo
Humic Gley soils intergrading to Alluvial.	Granitic alluvium.	Grangeville.					
			Solonetz soils intergrading to Alluvial.	Granitic alluvium.	Traver-------	------------	-----------
			Solonetz soils.	Granitic alluvium.	-------------	Waukena-----	Fresno.

POORLY DRAINED SOILS FROM UNCONSOLIDATED PARENT MATERIAL

Soils without a textural B horizon			Soils with a textural B horizon				
Great soil group	Parent material	Soil series	Great soil group	Parent material	Series, weak textural B horizon	Series, distinct textural B horizon	Series, cemented hardpan
Regosols------------------	Wind-deposited sand.	Dello.	Humic Gley soils.	Mixed alluvium----	Temple-------	------------	-----------
Humic Gley soils intergrading to Alluvial.	Granitic alluvium.	Foster.	Solonetz soils intergrading to Humic Gley.	Mixed alluvium----	-------------	Rossi-------	-----------

are uniformly coarse textured throughout. In places, however, the sand is deposited over a silty substratum or a buried soil of finer texture.

The imperfectly drained soils formed from unconsolidated parent material include Alluvial soils, Regosols, Grumusols, Solonetz soils, and several intergrades toward Humic Gley soils.

The Columbia soils are recent Alluvial soils. They are noncalcareous and have mottles caused by an intermittent high water table and summer floods. The Grangeville soils are similar to the Columbia but are classed as Humic Gley soils intergrading to Alluvial soils on the basis of their darker color and the higher content of organic matter in the A1 horizon. These soils are calcareous in the lower part.

The Hilmar soils are Regosols. They are made up of wind-deposited sands that rest on a silty substratum and are mottled and calcareous in the lower part because of an intermittent high water table.

The Paulsell soils are imperfectly drained Grumusols. They formed from lake sediments on nearly level relief and have a clay texture. The profile resembles that of the Raynor soils, but the subsoil contains more lime and has many manganese shot concretions.

The Bear Creek are considered to be Noncalcic Brown soils with Humic Gley characteristics that were caused by excessive wetness. They are associated with better drained Noncalcic Brown soils; because of their position, however, they are somewhat moister than the surrounding soils. They are grayish brown in color. The B horizon is fairly distinct and is mottled. Meikle and Alamo soils are considered to be Humic Gley soils with some characteristics of Planosols (claypan soils). They have formed in depressions that are ponded in spring. The Meikle soils have a thin A1 horizon that rests abruptly on a dense clay B horizon. The B horizon contains iron and manganese shot concretions and is calcareous in the lower part. The Alamo soils are dark-gray clays. They are mottled in the lower part and rest abruptly at about 18 inches on an iron-silica cemented hardpan.

The Waukena and Fresno are Solonetz soils that contain excess sodium and have a characteristic prismatic or columnar B horizon. The Waukena soils have a strongly alkaline columnar B horizon, whereas the Fresno soils have a cemented hardpan layer beneath a prismatic B horizon. The Traver soils are also strongly alkaline, but they have only a weakly developed textural B horizon and are classed as Solonetz soils intergrading to Alluvial soils.

The poorly drained soils from unconsolidated parent material include Regosols, Humic Gley soils, and Humic Gley soils intergrading to Alluvial soils, and Solonetz soils intergrading to Humic Gley soils.

The Dello soils are Regosols formed from wind-deposited sand and have a fluctuating high water table. These soils are mottled from the surface downward, and in many places they contain salts and some alkali. The Foster soils are Humic Gley soils intergrading to Alluvial soils. They are without a textural B horizon, but have a dark-colored A horizon and have pronounced mottling, and in many places contain salts. The Temple are Humic Gley soils. They are dark colored, are medium to fine textured, and have olive mottles in the subsoil. They are calcareous and, in places, saline. The Rossi soils are Solonetz soils intergrading to Humic Gley soils and are about intermediate between Temple and Waukena soils. They are dark colored but have a strongly alkaline clay B horizon with blocky structure.

Laboratory Analyses

Physical and Chemical Analyses[5]

The results of the physical and chemical analyses of representative soils of the Area are given in table 16. The soil samples were screened through a 2-millimeter, round-holed sieve. The aggregates were crushed with a rubber-tipped pestle. After being rubbed relatively clean, the gravel and stones larger than 2 millimeters in diameter were weighed to determine the percentage of gravel and were then discarded. The material that passed through the sieve was thoroughly mixed, and aliquot parts were used for the laboratory analyses. Methods used in obtaining the data given in table 16 are described in the paragraphs that follow.

Mechanical analyses.—The amount of sand was determined through the use of 10 grams of ovendried soil to which water and calgon (a sodium hexametaphosphate) had been added. This mixture was shaken overnight in a reciprocating shaker. The soil was then wet sieved through a 300-mesh screen, transferred to an evaporating dish, ovendried, and weighed. The total sand was expressed in percentage of the weight of the original ovendried sample. The dried sand was then fractionated through a nest of sieves in a mechanical shaker, and each fraction was weighed.

The amount of clay (particles below 2 microns in size) was determined by the hydrometer method. Fifty grams of soil, together with calgon as a dispersing agent, were shaken overnight in a reciprocating shaker and then transferred to a 1,000-centimeter cylinder. Hydrometer readings were taken at the proper intervals to record the amount of clay remaining in suspension. The results were expressed in percent of the ovendried soil.

The percentage of silt was determined by adding the percentage of sand and the percentage of clay and then subtracting the total from 100 percent.

Moisture equivalent.—The moisture equivalent represents approximately the normal field capacity—the amount of water that is held in a soil after a heavy rain or an irrigation—where drainage downward is free and uninterrupted.

Moisture equivalents were determined by the standard method in which 30 grams of saturated soil were subjected to a force of 1,000 gravity in a centrifuge. The results were reported as the percentage of moisture retained, calculated on the ovendry basis. A few soil samples were too compact to allow free passage of water, and water was retained on the surface of the soil after the centrifuge run. When this occurred, the procedure was repeated with another sample; waxed paper liners were used in the centrifuge cups to facilitate drainage.

[5] E. P. PERRY, associate specialist in soils, California Agricultural Experiment Station, Berkeley, Calif.

Permanent wilting point.—When a growing plant has taken water out of a soil to the point where the forces with which the soil retains water just balance the forces that the plant exerts to remove water, the leaves will become wilted and will not recover their turgidity unless water is added to the soil. The percentage of water remaining in the soil at this time is called the permanent wilting point, or percentage. This point was determined by growing dwarf sunflowers, then withholding water, and then measuring the amount of water remaining in the soil when the flowers became permanently wilted.

Pressure membrane studies.—Another method of measuring the force with which soil is able to hold water is that of subjecting saturated soil to different pressures and determining the amount of water the soil is able to retain. The soil samples were put into small rings on a membrane placed over a porous plate, were saturated with water, and were then placed in the pressure plate apparatus. The desired pressure was obtained with nitrogen gas. Some samples were held for 48 hours under ⅓ atmosphere pressure; others were held for 24 hours under 15 atmospheres pressure. The amount of moisture retained was then determined. The amount of moisture retained at ⅓ atmosphere pressure corresponds fairly closely with the moisture equivalent determination, and that retained at 15 atmospheres pressure, to the permanent wilting point.

Reaction.—The Beckman glass-electrode pH meter was used for the determination of the reaction of each soil. Approximately 50 grams of soil were saturated with distilled water and allowed to stand for 1 hour before the reading was made. A pH value of 7.0 designates a neutral soil. Values decreasing from 7.0 designate increasingly acid soils; values increasing from 7.0 designate increasingly alkaline soils.

Calcium carbonate.—The amount of calcium carbonate (lime) was determined for all soils having a pH value above 7.0. The Williams method was used. A known weight of soil was treated with hydrochloric acid in a sealed jar. The resulting pressure of the carbon dioxide gas produced was measured with a mercury manometer. The manometer was calibrated by measuring the pressure when pure calcium carbonate was treated similarly.

Bulk density.—The bulk density was determined by the zinc chloride method. A representative lump of the air-dried soil was given a thin coating of paraffin and then dropped into successive solutions of zinc chloride made up to standard true densities. The lowest density solution in which the lump will float gives the bulk density of the lump of soil.

Water-soluble phosphate.—The amount of water-soluble phosphate was determined by the modified Bingham method. The soil was extracted with water, and an aliquot of this water extract was tested. Phosphate ion in an acidic solution will form a relatively water-stable complex with a molybdate ion, which in the presence of stannous chloride turns blue. The intensity of the blue color developed is a measure of the amount of phosphate present in the aliquot sample.

Total nitrogen.—Nitrogen was determined by the Kjeldahl method. A weighed sample of soil was digested by boiling it in sulfuric acid in the presence of a mixture of copper sulfate, ferrous sulfate, and potassium sulfate, which converted the organic nitrogen to the ammonia form. After the addition of concentrated sodium hydroxide, the ammonia was driven off by steam distillation, collected in a 3-percent boric acid solution, and then titrated with hydrochloric acid; an indicator made by mixing methyl red and bromcresol green was used.

Carbon and organic matter.—The total carbon was determined by the dry combustion method. A weighed sample of soil was placed in a muffle and ignited at 900° C. in an oxygen stream. Any compound containing carbon was thus oxidized, and the carbon was released as carbon dioxide, which was then absorbed. The increase in weight of the absorbent (ascarite is used) is a direct measure of the carbon dioxide produced. The weight of carbon is converted to the weight of organic matter by multiplying by the factor 1.724.

Mineralogical Analyses of Clay Fractions [6]

Selected samples from profiles of different soils of the Eastern Stanislaus Area were analyzed for their content of clay minerals by differential thermal analyses and the X-ray method. The results of these tests are shown in table 17, and methods used in the analyses are discussed in the text that follows.

The clay suspension, obtained from the dispersed soil, is flocculated with sodium chloride (NaCl); after the supernatant liquid has been decanted, the clay is centrifuged and the supernatant solution is decanted. The clay paste in the centrifuge cup is then dispersed in about 10 milliliters of a glycerol-ethanol (1:2) solution and is centrifuged. After the clay settles to the bottom of the cup, the glycerol-ethanol solution is poured out and replaced with a fresh portion of the same solution and is centrifuged again until the clay completely settles to the bottom of the cup. The solution is then poured out, and the clay paste is placed on a watch glass and thoroughly mixed to insure uniform sampling. Next, the paste is packed in a specially prepared hypodermic needle (size 23) and forced out of the needle either with a syringe or a special tool designed for forming rods of uniform size. The rods are placed on a thin sheet or mylar plastic and X-rayed by the flat cassett method.

On the basis of the clay analyses, the soils of the Eastern Stanislaus Area can be placed into four groups (see table 17). Granitic alluvial soils generally fall into the two groups consisting of either kaolinite-mica-montmorillonite clay or kaolinite-mica-montmorillonite-vermiculite clay. The gravelly soils on terraces contain halloysite-montmorillonite-vermiculite clay, and the soils derived from basic igneous rock alluvium contain kaolinite-montmorillonite clay. The Columbia soil, derived from mixed rocks, contains kaolinite-mica-montmorillonite clay much like that of the granitic soils.

There seems to be no relationship between the kind of clay and the age of the soil, except for the presence of halloysite in the very old Redding and Corning soils. In other less ancient soils, the type of clay seems to be related to the kind of parent material from which the soils have formed.

[6] By ISAAC BARSHAD, lecturer in soils and plant nutrition and associate soil chemist, California Agricultural Experiment Station, Berkeley, Calif.

TABLE 16. -*Physical and chemical*

Soil type	Laboratory No. (Cal 50)	Depth	Gravel (>2 mm.)	Sand: Very coarse	Sand: Coarse	Sand: Medium	Sand: Fine	Sand: Very fine	Sand: Total (2 mm. to 0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Amador loam	11–1	0–6	20. 6						33. 6
	11–2	6–13	14. 7	--------	--------	--------	--------	--------	31. 9
Bear Creek clay loam	31–1	0–6	13. 7	2. 6	2. 8	6. 8	20. 6	18. 6	51. 4
	31–2	6–21	14. 7	--------	--------	--------	--------	--------	50. 8
	31 3	21–36	38. 2	--------	--------	--------	--------	--------	62. 0
	31–4	36–53	60. 4	--------	--------	--------	--------	--------	70. 3
Chualar sandy loam	43–1	0–6	4. 5	12. 6	27. 7	19. 0	14. 5	5. 5	79. 3
	43–2	6–14	6. 1	15. 4	32. 5	16. 9	10. 7	3. 9	79. 4
	43–3	14–24	6. 0	13. 7	29. 4	18. 3	12. 8	4. 2	78. 4
	43–4	24–32	4. 0	13. 4	20. 3	23. 8	11. 9	4. 5	73. 9
	43–5	32–48	4. 2	11. 6	25. 7	15. 7	10. 6	4. 3	67. 9
	43–6	48–58	4. 5	10. 5	23. 1	23. 3	9. 7	3. 6	70. 2
	43–7	58–72	5. 0	13. 8	33. 2	18. 7	11. 6	3. 2	80. 5
Columbia loam	25 1	0 7	--------	. 7	. 5	. 8	7. 8	18. 8	28. 6
	25–2	7–13	--------	--------	--------	--------	--------	--------	44. 6
	25–3	13–40	--------	--------	--------	--------	--------	--------	72. 1
	25–4	40–60	--------	--------	--------	--------	--------	--------	50. 9
Corning gravelly sandy loam	35–1	0–8	26. 4	14. 1	22. 6	13. 7	14. 6	8. 8	73. 8
	35–2	8–16	57. 6	14. 1	24. 0	21. 2	11. 9	4. 2	75. 4
	35–3	16–26	11. 3	16. 6	46. 1	10. 8	5. 2	1. 5	80. 2
	35 4	26 39	63. 5	17. 4	31. 0	19. 1	9. 4	2. 4	79. 3
	35–5	39+	56. 8	14. 4	27. 8	24. 7	8. 7	2. 4	78. 0
Delhi sand	20–1	0–12	--------	1. 6	29. 9	46. 7	13. 2	1. 9	93. 3
	20 -2	12 24	--------	1. 5	36. 3	45. 1	9. 3	1. 5	93. 7
	20–3	24 60	--------	--------	--------	--------	--------	--------	--------
Dinuba sandy loam	2–1	0–4	--------	3. 8	8. 8	13. 5	19. 6	15. 2	60. 9
	2–2	4–8	--------	--------	--------	--------	--------	--------	62. 0
	2–3	8–18	--------	--------	--------	--------	--------	--------	61. 1
	2–4	18–28	--------	--------	--------	--------	--------	--------	59. 7
	2–5	28 -36	--------	--------	--------	--------	--------	--------	44. 6
	2–6	36–60	--------	--------	--------	--------	--------	--------	58. 6
Exchequer rocky loam	13–1	0–8	--------	--------	--------	--------	--------	--------	42. 8
	13–2	8–13	--------	--------	--------	--------	--------	--------	42. 6
Fresno fine sandy loam	41–1	¼–5	--------	2. 4	6. 2	10. 6	16. 7	14. 2	50. 1
	41–2	5–10	--------	2. 1	7. 9	7. 8	15. 6	14. 7	48. 1
	41–3	10–18	--------	1. 0	2. 9	6. 2	11. 9	15. 4	37. 4
	41–4	18–29	--------	1. 3	3. 6	2. 9	4. 8	8. 1	20. 7
	41 5	29–38	1. 1	. 7	3. 6	2. 9	5. 4	8. 4	21. 0
	41–6	38–40	--------	11. 6	11. 5	5. 0	6. 2	6. 6	40. 9
	41–7	40+	--------	1. 3	3. 5	6. 0	9. 3	8. 7	28. 8
Grangeville very fine sandy loam	23–1	0–7	--------	1. 2	1. 0	. 8	8. 4	34. 0	45. 4
	23–2	7–20	--------	--------	--------	--------	--------	--------	47. 7
	23–3	20–40	--------	--------	--------	--------	--------	--------	52. 7
	23–4	40–60	--------	--------	--------	--------	--------	--------	50. 0
Greenfield sandy loam	18–1	0–9	. 8	2. 6	7. 1	13. 6	20. 0	21. 8	65. 1
	18–2	9–21	--------	1. 9	6. 1	13. 7	20. 7	22. 9	65. 3
	18–3	21–42	--------	1. 7	9. 0	10. 6	20. 4	19. 3	61. 0
	18–4	42–52	--------	1. 5	9. 1	10. 4	20. 9	22. 4	64. 3
	18–5	52–70	--------	. 9	6. 8	9. 7	24. 7	26. 4	68. 5
Greenfield sandy loam, deep over hardpan	26–1	0–7	--------	1. 1	3. 8	11. 2	18. 8	23. 8	58. 7
	26–2	7–15	--------	1. 0	7. 0	9. 5	18. 0	23. 8	59. 3
	26–3	15–24	--------	1. 0	3. 9	10. 4	16. 9	30. 2	62. 4
	26–4	24–32	--------	1. 3	4. 6	12. 0	17. 2	27. 1	62. 2
	26–5	32–34	--------	1. 5	6. 0	8. 1	8. 7	20. 9	55. 2

analyses of soil samples

Silt (0.05 mm. to 0.002 mm.)	Clay		Bulk density	Moisture retention values				Organic matter	Total nitrogen	Carbon-nitrogen ratio	Reaction	Calcium carbonate	Water-soluble phosphate
	<0.002 mm.	<0.001 mm.		⅓ atmos.	15 atmos.	Moisture equivalent	Permanent wilting point						
Percent	*Percent*	*Percent*	*Gm. per cc.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*pH*	*Percent*	*P.p.m.*
46. 4	20. 0	13. 0	1. 6	--------	--------	19. 7	6. 3	1. 15	0. 0489	13. 6	4. 7	--------	--------
46. 1	22. 0	17. 0	1. 5	--------	--------	19. 5	7. 8	. 594	. 0303	11. 4	4. 7	--------	--------
25. 6	23. 0	19. 0	1. 6	21. 2	10. 1	20. 3	--------	1. 56	. 0882	10. 3	6. 1	--------	0. 14
24. 2	26. 0	23. 0	1. 8	22. 9	9. 64	22. 0	--------	--------	--------	--------	6. 4	--------	. 07
26. 0	22. 0	20. 0	1. 8	21. 7	11. 1	22. 0	--------	--------	--------	--------	6. 6	--------	--------
9. 7	20. 0	18. 0	1. 7	--------	--------	19. 2	--------	--------	--------	--------	6. 9	--------	--------
11. 7	9. 0	7. 0	1. 6	6. 7	3. 0	7. 2	--------	--------	. 053	10. 0	5. 5	--------	1. 0
9. 6	11. 0	9. 0	1. 7	7. 1	3. 6	8. 3	--------	--------	. 025	9. 2	6. 1	--------	1. 5
10. 6	11. 0	9. 0	1. 7	7. 4	3. 8	8. 2	--------	--------	. 021	8. 1	6. 2	--------	1. 5
12. 1	14. 0	11. 0	1. 9	10. 5	5. 1	10. 6	--------	--------	. 017	6. 5	6. 2	--------	1. 1
15. 1	17. 0	14. 0	1. 9	13. 2	6. 2	13. 1	--------	--------	. 014	5. 7	6. 5	--------	. 82
12. 8	17. 0	14. 0	1. 9	13. 2	6. 5	13. 3	--------	--------	. 014	7. 9	6. 5	--------	. 84
8. 5	11. 0	9. 0	1. 6	8. 1	4. 0	7. 9	--------	--------	. 008	7. 5	6. 7	--------	. 74
42. 4	29. 0	22. 0	1. 4–1. 2	--------	14. 3	30. 0	11. 4	3. 28	. 171	11. 1	5. 7	--------	. 20
33. 4	22. 0	17. 0	1. 5–1. 3	--------	11. 0	24. 1	9. 9	--------	--------	--------	7. 0	--------	--------
17. 9	10. 0	8. 0	1. 4–1. 5	--------	6. 9	12. 0	4. 7	--------	--------	--------	6. 9	--------	--------
35. 1	14. 0	11. 0	1. 5	--------	7. 8	18. 8	--------	--------	--------	--------	6. 5	--------	--------
15. 2	11. 0	10. 0	1. 9	9. 90	1. 70	10. 4	--------	1. 12	. 0566	11. 5	6. 3	--------	. 85
7. 6	17. 0	16. 0	1. 9	9. 78	3. 29	11. 9	--------	. 471	. 0303	9. 01	5. 9	--------	. 55
1. 8	18. 0	16. 0	1. 9	10. 9	5. 92	13. 2	--------	--------	--------	--------	5. 6	--------	. 69
. 7	20. 0	18. 0	--------	14. 3	8. 88	15. 8	--------	--------	--------	--------	6. 1	--------	--------
3. 0	19. 0	18. 0	--------	15. 0	8. 03	16. 1	--------	--------	--------	--------	6. 1	--------	--------
2. 7	4. 0	3. 0	--------	3. 11	1. 9	4. 2	1. 4	--------	--------	--------	6. 6	--------	2. 0
3. 3	3. 0	3. 0	1. 7	2. 75	1. 7	3. 5	1. 3	--------	--------	--------	6. 6	--------	--------
--------	4. 0	3. 5	1. 3	2. 43	1. 7	3. 5	1. 4	--------	--------	--------	6. 4	--------	--------
27. 1	12. 0	10. 0	1. 7	12. 4	3. 94	12. 5	4. 2	1. 08	. 0647	9. 66	6. 6	--------	--------
25. 0	13. 0	11. 0	1. 8	11. 7	3. 70	12. 5	4. 1	--------	--------	--------	6. 2	--------	--------
24. 9	14. 0	12. 0	1. 8	11. 8	3. 65	12. 2	4. 3	--------	--------	--------	6. 3	--------	--------
25. 3	15. 0	13. 0	1. 8	12. 2	3. 92	12. 6	4. 6	--------	--------	--------	6. 4	--------	--------
31. 4	24. 0	18. 0	1. 8	20. 1	--------	18. 9	--------	--------	--------	--------	6. 3	--------	--------
28. 9	12. 5	9. 0	1. 7	17. 1	--------	17. 2	--------	--------	--------	--------	8. 2	4. 7	--------
36. 7	20. 5	13. 0	1. 6	--------	--------	19. 7	7. 8	1. 12	. 0627	11. 0	6. 2	--------	--------
38. 9	18. 5	13. 0	1. 6	21. 3	7. 04	19. 7	--------	--------	--------	--------	6. 3	--------	--------
41. 9	8. 0	6. 0	1. 8	13. 6	2. 82	13. 2	--------	--------	. 0495	12. 2	6. 9	--------	. 62
33. 9	18. 0	16. 0	1. 9	21. 8	7. 72	9. 8	--------	--------	. 0260	8. 0	8. 8	. 73	. 56
42. 6	20. 0	16. 0	1. 8	23. 2	7. 94	11. 2	--------	--------	--------	--------	9. 7	. 46	--------
58. 3	21. 0	16. 0	1. 7	28. 9	8. 40	15. 4	--------	--------	--------	--------	9. 8	1. 01	--------
56. 0	23. 0	18. 0	1. 7	28. 6	9. 10	16. 7	--------	--------	--------	--------	9. 7	. 91	--------
38. 1	21. 0	16. 0	1. 7	19. 8	5. 89	11. 1	--------	--------	--------	--------	9. 7	29. 60	--------
54. 2	17. 0	12. 0	1. 8	25. 3	6. 05	15. 0	--------	--------	--------	--------	9. 3	. 36	--------
44. 6	10. 0	7. 0	1. 4–1. 2	24. 9	7. 8	22. 3	6. 9	2. 72	. 124	12. 7	7. 3	. 67	. 80
42. 3	10. 0	8. 0	1. 4–1. 2	23. 9	7. 2	21. 1	7. 6	--------	--------	--------	7. 5	. 67	. 21
39. 3	8. 0	6. 0	1. 2	16. 1	7. 4	18. 6	6. 0	--------	--------	--------	7. 4	. 28	--------
43. 0	7. 0	6. 0	--------	--------	6. 5	18. 0	--------	--------	--------	--------	7. 6	. 43	--------
23. 9	11. 0	10. 0	1. 6	10. 8	3. 4	12. 3	--------	. 757	. 0377	11. 6	6. 8	--------	. 84
22. 7	12. 0	11. 0	1. 6	9. 95	2. 9	12. 0	3. 9	. 471	. 0285	9. 25	6. 8	--------	1. 0
25. 0	14. 0	13. 0	1. 7	--------	4. 4	13. 1	--------	--------	--------	--------	6. 8	--------	2. 0
26. 7	9. 0	8. 0	1. 7	--------	3. 7	10. 5	--------	--------	--------	--------	7. 0	--------	--------
24. 5	7. 0	6. 0	1. 7	--------	--------	8. 5	3. 1	--------	--------	--------	7. 0	--------	--------
28. 3	13. 0	10. 0	1. 8	12. 9	4. 9	12. 4	--------	--------	--------	--------	5. 8	--------	--------
26. 7	14. 0	12. 0	1. 7	13. 5	5. 1	12. 7	--------	--------	--------	--------	5. 6	--------	--------
22. 6	15. 0	12. 0	1. 5	13. 8	5. 3	13. 1	--------	--------	--------	--------	6. 0	--------	--------
24. 8	13. 0	11. 0	1. 7	14. 7	3. 9	13. 5	--------	--------	--------	--------	6. 3	--------	--------
28. 8	16. 0	14. 0	--------	--------	--------	14. 8	--------	--------	--------	--------	6. 8	--------	--------

TABLE 16.—*Physical and chemical*

Soil type	Laboratory No. (Cal 50)	Depth	Gravel (>2 mm.)	Sand					
				Very coarse	Coarse	Medium	Fine	Very fine	Total (2 mm. to 0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Hanford sandy loam	3-1	0-12	0.9	6.1	18.7	13.5	20.9	15.3	74.5
	3-2	12-24	.9						75.4
	3-3	24-36	1.1						78.0
	3-4	36-48	1.0						76.8
	3-5	48-60	.9						75.9
Hanford sandy loam, moderately deep over silt	1-1	0-6		4.2	7.7	15.1	22.7	17.4	67.1
	1-2	6-12							65.1
	1-3	12-24							65.2
	1-4	24-35							64.7
	1-5	35-48							47.0
	1-6	48-60							20.7
Hilmar loamy sand	45-1	0-7		.4	3.4	19.7	48.5	21.3	93.3
	45-2	7-14		1.5	13.2	20.0	36.5	17.6	88.8
	45-3	14-21		1.1	7.0	22.2	37.1	18.5	85.9
	45-4	21-29		1.8	12.2	16.8	31.1	16.9	78.8
	45-5	29-66		4.6	8.3	12.3	15.2	17.6	58.0
Honcut loam	24-1	0-10		.4	2.0	7.0	22.9	19.7	52.0
	24-2	10-26							61.7
	24-3	26-41							65.9
	24-4	41-60							71.2
Hopeton clay loam	16-1	0-11	.7						38.7
	16-2	11-20							30.7
	16-3	20-29	.5						36.4
	16-4	29-38	.6						39.9
Hornitos gravelly fine sandy loam	12-1	0-7	5.4	2.9	4.7	6.1	43.1	14.1	70.9
	12-2	7-9							55.7
Keyes cobbly clay loam	8-1	0-3	9.1						35.4
	8-2	3-8	5.1						34.4
	8-3	8-12	5.9						32.8
	8-4	12-16	26.6						29.2
Meikle clay	14-1	0-4							46.6
	14-2	4-16							33.5
	14-3	16-24							37.8
	14-4	24-36							46.9
	14-5	36-48		2.0	5.6	6.7	22.0	22.1	58.4
	14-6	48-60	.3						43.7
Modesto loam	42-1	0-10		4.9	12.6	11.2	15.3	9.2	53.2
	42-2	10-12		5.1	9.0	14.6	15.0	8.2	51.9
	42-3	12-25		4.7	11.2	10.8	13.7	6.6	47.0
	42-4	25-35		6.0	10.4	17.2	15.6	6.9	56.1
	42-5	35-44		6.3	15.7	16.6	22.4	8.4	69.4
	42-6	44-55		5.7	9.9	16.7	20.6	12.6	65.5
	42-7	55-62		.5	1.5	1.2	1.9	1.1	6.2
Montpellier coarse sandy loam	4-1	0-8	1.9	10.9	17.6	19.4	12.5	7.8	68.2
	4-2	8-18	1.6	10.4	23.4	12.5	11.2	6.8	64.3
	4-3	18-28	1.8	11.6	20.4	10.6	9.3	5.4	57.3
	4-4	28-39	2.5	11.0	22.2	10.7	7.2	6.7	57.8
	4-5	39-45		14.8	20.7	16.9	10.7	4.7	67.8
Oakdale sandy loam	22-1	0-1	7.4	13.2	18.5	21.1	14.7	8.0	75.5
	22-2	1-13	6.8						76.7
	22-3	13-25	5.0						73.8
	22-4	25-38	6.1						73.0
	22-5	38-45	8.0						80.7
	22-6	45-60	13.4						87.4

analyses of soil samples—Continued

Silt (0.05 mm. to 0.002 mm.)	Clay <0.002 mm.	Clay <0.001 mm.	Bulk density	Moisture retention values ⅓ atmos.	Moisture retention values 15 atmos.	Moisture retention values Moisture equivalent	Moisture retention values Permanent wilting point	Organic matter	Total nitrogen	Carbon-nitrogen ratio	Reaction	Calcium carbonate	Water-soluble phosphate
Percent	*Percent*	*Percent*	*Gm. per cc.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*pH*	*Percent*	*P.p.m.*
16.0	9.5	9.0	1.8	6.63	2.20	7.6	2.8	0.451	0.0334	7.81	6.1	----	----
15.6	9.0	8.0	1.7	5.93	----	6.6	2.5	.275	.0214	7.42	6.5	----	----
13.0	9.0	8.0	1.6	5.90	----	6.4	2.5	.294	.0214	7.99	6.8	----	----
14.2	9.0	8.0	1.7	----	----	6.5	2.6	.175	----	----	6.8	----	----
14.1	10.0	8.0	1.7	----	----	6.9	----	.261	----	----	6.7	----	----
21.9	11.0	8.0	1.6	9.71	2.93	10.7	3.1	.926	.0612	8.77	5.9	----	----
22.9	12.0	9.0	1.5	10.0	2.89	10.1	3.5	.498	.0322	8.97	6.2	----	----
23.8	11.0	9.0	1.5	9.41	2.90	9.6	3.1	----	----	----	6.2	----	----
24.3	11.0	9.0	1.5	10.1	3.04	10.1	3.3	----	----	----	6.4	----	----
40.0	13.0	10.0	1.6	11.2	----	16.4	----	----	----	----	6.5	----	----
65.3	14.0	9.0	1.5	30.2	----	25.7	----	----	----	----	8.0	1.3	----
2.7	4.0	3.0	----	2.6	1.9	3.6	----	----	.023	9.1	6.5	----	0.63
6.2	5.0	4.0	----	3.7	----	4.2	----	----	.016	9.4	7.0	.05	.83
9.1	5.0	4.0	----	3.8	1.6	4.2	----	----	.013	7.7	7.4	.07	.98
13.2	8.0	7.0	----	8.4	3.2	8.4	----	----	.007	7.1	8.0	3.4	.37
32.0	10.0	7.0	----	17.7	4.6	16.3	----	----	.008	6.3	8.6	18.1	.10
25.0	23.0	20.0	1.5–1.4	21.2	12.1	20.8	9.2	.969	.0495	11.4	6.3	----	.47
17.3	21.0	18.0	1.5–1.4	19.3	10.5	19.7	8.5	----	----	----	6.3	----	.42
15.1	19.0	16.0	1.5 1.4	17.4	9.7	18.3	8.3	----	----	----	6.4	----	----
12.8	16.0	14.0	1.4	15.7	8.7	16.6	----	----	----	----	6.6	----	----
36.3	25.0	24.0	1.8	----	----	20.0	7.9	1.17	.0706	9.61	5.9	----	.17
27.3	42.0	39.0	1.9	----	----	35.7	14.1	.536	.0463	6.71	6.8	----	.19
33.6	33.0	31.0	1.9	----	----	31.7	11.6	----	----	----	7.5	.00	.22
29.1	31.0	31.0	1.9	----	----	33.8	11.3	----	----	----	7.7	----	----
13.1	16.0	12.0	1.7	----	----	12.4	5.5	.963	.0398	14.1	5.9	----	----
10.3	34.0	29.0	1.6	----	----	21.5	12.1	.819	.0345	13.7	5.5	----	----
40.6	24.0	10.0	1.8	22.5	9.43	21.1	9.3	2.09	.113	10.7	5.8	----	.11
39.6	26.0	22.0	1.6	20.8	9.61	19.8	8.9	1.15	.0556	12.0	6.2	----	.04
38.2	29.0	25.0	1.5	22.6	10.8	21.7	10.1	----	----	----	6.4	----	----
20.8	50.0	46.0	1.8	38.0	22.0	37.7	20.0	----	----	----	6.0	----	----
26.9	26.1	26.0	1.9	21.6	10.1	21.2	----	1.36	.0832	9.44	6.0	----	.04
22.5	44.0	42.0	1.9	28.1	15.6	34.3	12.2	.841	.0460	10.6	6.8	----	.06
20.2	42.0	39.0	1.9	23.4	8.79	32.0	----	----	----	----	7.7	----	.17
23.1	30.0	27.0	1.9	----	----	21.3	----	----	----	----	7.7	.28	----
20.6	21.0	20.0	1.8	----	----	18.4	----	----	----	----	7.2	----	----
35.3	21.0	17.0	1.8	----	----	21.4	8.3	----	----	----	7.2	.00	----
30.8	16.0	13.0	----	16.7	6.43	15.7	----	----	----	----	5.8	----	.20
24.1	24.0	20.0	1.7	17.8	6.28	16.4	----	----	----	----	6.1	----	----
23.0	30.0	27.0	2.0	20.8	11.7	20.0	----	----	----	----	6.3	----	.10
17.9	26.0	23.0	1.9	31.1	9.92	18.8	----	----	----	----	6.7	----	.14
13.6	17.0	15.0	1.8	13.6	6.98	13.8	----	----	----	----	6.8	----	----
12.5	17.0	16.0	1.8	16.1	7.46	16.1	----	----	----	----	6.8	----	----
51.8	42.0	26.0	1.5	38.3	14.3	35.3	----	----	----	----	6.9	----	----
19.8	12.0	9.0	1.8	9.86	2.41	9.4	2.8	.740	.0433	9.91	6.4	----	.09
18.7	17.0	13.0	1.7	9.63	3.68	10.1	4.0	.289	.0254	6.46	6.3	----	.02
12.6	29.0	27.0	1.7	14.2	7.97	14.4	7.7	.235	----	----	5.8	----	.00
12.7	28.0	27.0	1.6	15.9	8.75	16.0	8.5	.131	----	----	5.9	----	.00
9.8	22.0	20.0	1.8	----	----	12.7	----	----	----	----	7.0	----	----
18.5	6.0	4.0	----	----	23.8	22.9	----	11.7	.558	12.1	6.8	----	----
13.3	10.0	8.0	1.8 1.6	8.38	3.4	10.1	2.8	.762	.0475	9.30	6.8	----	6.6
14.2	12.0	10.0	1.7–1.6	7.76	3.8	10.4	3.6	----	----	----	7.0	.00	5.1
10.0	17.0	15.0	1.9–1.5	10.8	6.4	14.5	5.7	----	----	----	6.9	----	----
7.3	12.0	11.0	1.9	----	4.6	11.6	----	----	----	----	6.8	----	----
3.6	9.0	8.0	1.7	----	4.3	8.7	----	----	----	----	6.9	----	----

TABLE 16.—*Physical and chemical*

Soil type	Laboratory No. (Cal 50)	Depth	Gravel (>2 mm.)	Sand: Very coarse	Sand: Coarse	Sand: Medium	Sand: Fine	Sand: Very fine	Sand: Total (2 mm. to 0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Paulsell clay	19-1	0-12							8.0
	19-2	12-24							13.2
	19-3	24-36							17.0
	19-4	36-50		0.5	1.7	8.5	24.9	20.0	55.6
Pentz cobbly loam, very shallow	6-1	0-4	10.0						48.5
Pentz gravelly loam	32-1	0-3	12.2	2.8	4.8	7.0	15.1	13.5	43.2
	32-2	3-8		.5	1.5	8.0	46.3	22.8	79.1
	32-3	8+	9.2	2.9	5.7	5.5	19.3	15.8	49.2
Peters clay	7-1	0-8							14.6
	7-2	8-16							
Raynor clay	33-1	0-15	3.6	1.8	4.0	3.8	7.5	6.8	23.9
	33-2	15-30	8.0	2.1	3.6	3.3	6.8	6.8	22.6
	33-3	30-39	10.3	1.8	2.5	3.8	6.2	6.3	20.6
	33-4	39-50	1.7	1.1	3.0	2.5	5.4	6.4	18.4
	33-5	50+	10.2	2.5	5.3	7.9	17.1	11.3	44.1
Redding gravelly loam	15-1	0-3	18.2	5.4	7.5	6.7	6.2	19.8	45.6
	15-2	3-12	22.8	5.4	5.2	7.7	12.1	12.6	43.0
	15-3	12-18	15.4	3.0	2.9	3.6	5.7	6.5	21.7
	15-4	18-28	47.2	19.6	21.6	10.2	11.6	7.1	70.1
	15-5	28-52	60.7	13.2	15.7	12.1	6.1	5.1	52.2
Rocklin sandy loam	29-1	0-7		1.1	8.5	13.3	25.6	15.3	63.8
	29-2	7-9		1.3	7.9	13.0	24.5	16.3	63.0
	29-3	9-17		1.2	5.2	15.8	24.9	14.2	61.3
	29-4	17-22		.6	5.2	15.7	23.8	13.4	58.7
	29-5	22-28		1.3	7.2	11.2	21.4	13.4	54.5
Rossi clay	38-1	0-3		1.1	2.0	2.2	2.6	3.3	11.2
	38-2	3-11		1.0	2.2	1.4	2.2	2.8	9.6
	38-3	11-21		1.5	1.7	1.7	2.0	2.9	9.8
	38-4	21-38		1.6	2.3	1.2	1.9	2.4	9.4
	38-5	38-56	5.4	4.9	3.1	2.5	3.2	6.9	20.6
Ryer clay loam	10-1	0-8							13.9
	10-2	8-16							13.0
	10-3	16-25							12.9
	10-4	25-37							11.7
	10-5	37-48							10.9
	10-6	48-62							21.6
San Joaquin sandy loam	30-1	0-3		10.3	13.7	9.5	13.9	10.8	58.2
	30-2	3-10		8.2	13.5	5.6	10.9	15.9	54.1
	30-3	10-13		4.7	8.6	10.1	12.2	14.2	49.9
	30-4	13-19		5.2	8.0	9.2	11.6	11.3	45.3
	30-5	19-24		5.1	7.6	8.6	10.6	10.2	42.1
	30-6	24-48							
	30-7	48-60		7.0	10.3	11.2	12.9	12.5	53.9
Snelling sandy loam	36-1	0-15	1.0	9.7	21.6	15.7	21.2	11.2	79.4
	36-2	15-19	[1]	8.3	19.1	15.6	22.2	12.4	77.6
	36-3	19-27	[1]	8.9	14.6	18.7	20.8	10.9	73.9
	36-4	27-40	[1]	5.4	14.4	13.4	21.9	13.6	68.7
	36-5	40-56	1.8	8.7	14.7	17.6	24.4	11.2	76.6
	36-6	56-74	3.6	23.7	31.7	14.7	12.4	2.2	84.7
Temple silty clay	40-1	0-8½		.2	.7	.4	2.0	3.6	6.9
	40-2	8½-15		.1	.2	.3	1.3	4.0	5.9
	40-3	15-21		.2	.3	.2	1.4	4.7	6.8
	40-4	21-26		.6	.4	.3	1.2	7.2	9.7
	40-5	26-31		1.2	1.1	.5	1.8	16.4	21.0
	40-6	31-44		.8	1.9	1.1	4.3	35.5	43.6
	40-7	44-60		10.9	36.4	14.5	27.6	3.8	93.2

[1] Trace.

analyses of soil samples—Continued

Silt (0.05 mm. to 0.002 mm.)	Clay		Bulk density	Moisture retention values				Organic matter	Total nitrogen	Carbon-nitrogen ratio	Reaction	Calcium carbonate	Water-soluble phosphate
	<0.002 mm.	<0.001 mm.		⅓ atmos.	15 atmos.	Moisture equivalent	Permanent wilting point						
Percent	*Percent*	*Percent*	*Gm. per cc.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*pH*	*Percent*	*P.p.m.*
40. 0	52. 0	46. 0	1. 9	35. 6	21. 0	41. 0	----	----	----	----	6. 2	----	0. 14
34. 8	52. 0	47. 0	1. 9	----	21. 0	38. 0	----	----	----	----	7. 0	----	. 44
37. 0	46. 0	41. 0	1. 8	----	19. 0	31. 7	----	----	----	----	7. 6	----	----
26. 4	18. 0	17. 0	1. 8	----	10. 2	20. 1	----	----	----	----	7. 3	----	----
34. 5	17. 0	15. 0	1. 8	----	----	18. 7	8. 3	----	----	----	6. 2	----	----
31. 8	25. 0	22. 0	1. 8	25. 6	9. 50	23. 1	----	2. 14	0. 124	10. 0	5. 7	----	. 29
13. 9	7. 0	6. 0	1. 6	17. 3	9. 68	----	----	. 202	. 0102	10. 9	6. 3	----	. 19
24. 0	27. 0	24. 0	1. 7	22. 9	12. 7	22. 3	----	----	----	----	5. 9	----	----
36. 4	49. 0	43. 0	1. 9	34. 6	19. 0	32. 5	----	1. 95	. 113	10. 0	6. 1	----	. 23
----	48. 0	42. 0	2. 0	37. 3	22. 8	34. 5	----	1. 22	. 0656	10. 8	6. 4	----	. 04
36. 1	40. 0	35. 0	2. 0	30. 6	16. 6	26. 0	----	1. 12	. 0551	11. 7	5. 8	----	. 05
32. 4	45. 0	38. 0	1. 9	35. 9	21. 4	31. 1	----	. 579	. 0284	11. 8	6. 5	–	. 06
34. 4	46. 0	42. 0	1. 8	38. 8	21. 1	33. 1	----	----	----	----	7. 1	0. 02	. 07
35. 6	46. 0	41. 0	1. 9	41. 4	20. 7	33. 6	----	----	----	----	7. 5	. 82	----
23. 9	32. 0	27. 0	----	34. 1	18. 8	29. 4	----	----	----	----	7. 5	1. 7	----
41. 4	13. 0	10. 0	1. 9	16. 3	4. 01	15. 0	----	1. 03	. 0541	11. 0	6. 0	----	. 07
42. 0	15. 0	14. 0	1. 9	15. 2	4. 44	15. 4	----	. 493	. 0334	8. 56	5. 7	----	. 06
43. 3	55. 0	32. 0	1. 9	34. 4	20. 0	34. 0	----	----	----	----	5. 1	----	. 09
----	31. 0	30. 0	1. 9	----	----	20. 9	----	----	----	----	6. 5	----	----
30. 8	17. 0	15. 0	1. 8	----	----	24. 8	----	----	----	----	7. 1	----	----
27. 2	9. 0	7. 0	1. 7	9. 34	2. 1	9. 5	2. 4	. 645	. 0319	11. 7	5. 2	----	. 04
27. 0	10. 0	7. 0	1. 8	----	----	9. 8	----	. 512	. 0310	9. 58	5. 2	----	. 05
26. 7	12. 0	9. 0	1. 9	----	----	9. 8	----	----	----	----	5. 9	----	. 03
27. 3	14. 0	12. 0	1. 9	----	----	11. 1	----	----	----	----	6. 4	----	----
66. 5	22. 0	20. 0	1. 9	----	----	14. 1	----	----	----	----	6. 8	----	----
52. 8	36. 0	25. 0	1. 6	38. 7	15. 7	28. 3	----	----	. 152	12. 2	7. 7	. 07	7. 05
30. 4	60. 0	49. 0	1. 9	56. 8	56. 0	32. 0	----	----	. 0775	11. 0	9. 0	1. 28	----
27. 2	63. 0	53. 0	1. 9	96. 4	68. 6	32. 3	----	----	. 0421	11. 0	9. 4	1. 94	----
29. 6	61. 0	51. 0	1. 9	88. 4	63. 0	25. 5	----	----	----	----	9. 4	1. 87	----
46. 4	33. 0	25. 0	1. 8	48. 6	22. 8	23. 7	----	----	----	----	9. 2	7. 46	----
54. 1	32. 0	25. 0	1. 6	----	----	23. 7	11. 2	1. 55	----	----	6. 1	----	----
53. 0	34. 0	27. 0	1. 5	----	----	22. 2	11. 0	. 845	. 0458	10. 7	6. 3	----	----
50. 6	36. 5	29. 0	1. 6	----	----	23. 5	12. 0	. 753	----	----	6. 4	----	----
50. 8	37. 5	28. 0	1. 6	----	----	23. 8	8. 0	. 501	----	----	6. 5	----	----
55. 1	34. 0	25. 0	1. 3	----	----	25. 5	13. 2	. 348	----	----	6. 5	----	----
53. 4	25. 0	19. 0	----	----	----	24. 6	----	----	----	----	6. 6	----	----
31. 8	10. 0	7. 0	1. 5	15. 2	7. 5	16. 3	----	----	----	----	6. 0	----	----
34. 9	11. 0	9. 0	1. 8	11. 9	3. 8	12. 6	3. 3	----	----	----	5. 6	----	. 35
32. 1	18. 0	14. 0	1. 8	12. 9	6. 9	13. 2	----	----	----	----	5. 8	----	. 03
32. 7	22. 0	19. 0	1. 8	15. 2	6. 6	15. 0	6. 5	----	----	----	6. 0	----	. 01
23. 9	34. 0	25. 0	1. 9	20. 0	10. 6	19. 0	----	----	----	----	6. 2	----	. 01
----	----	----	1. 9	----	----	----	----	----	----	----	7. 1	. 30	----
24. 1	22. 0	19. 0	1. 9	19. 6	----	----	----	----	----	----	7. 3	. 00	----
12. 6	8. 0	6. 0	1. 7	6. 56	1. 99	7. 9	----	. 574	. 0320	10. 4	6. 3	----	1. 0
12. 4	10. 0	8. 0	1. 9	7. 85	3. 04	8. 3	----	. 13	. 0127	6. 0	6. 3	----	. 57
12. 1	14. 0	11. 0	2. 0	9. 06	4. 67	9. 7	----	----	----	----	5. 6	----	. 21
11. 3	20. 0	17. 0	1. 8	14. 2	7. 34	14. 1	----	----	----	----	5. 4	----	. 21
5. 4	18. 0	16. 0	1. 8	12. 1	6. 84	13. 3	----	----	----	----	6. 1	----	----
. 3	15. 0	14. 0	1. 6	9. 28	5. 78	10. 9	----	----	----	----	6. 2	----	----
41. 1	52. 0	37. 0	1. 4	50. 0	22. 5	36. 2	----	----	. 200	11. 4	7. 3	. 04	1. 58
34. 1	60. 0	27. 0	1. 7	50. 4	27. 6	33. 9	----	----	. 0940	17. 1	7. 9	. 16	. 31
38. 2	55. 0	41. 0	1. 7	46. 2	24. 1	32. 2	----	----	. 0651	13. 0	7. 9	. 33	. 22
42. 3	48. 0	38. 0	1. 8	40. 3	23. 1	29. 0	----	----	----	----	8. 0	1. 42	----
46. 0	33. 0	26. 0	1. 8	32. 2	14. 8	24. 4	----	----	----	----	8. 0	3. 03	----
38. 4	18. 0	13. 0	1. 6	26. 4	8. 75	19. 6	----	----	----	----	7. 9	. 71	----
4. 8	2. 0	1. 0	1. 6	3. 45	2. 14	4. 0	----	----	----	----	7. 5	----	----

Table 16.—*Physical and chemical*

Soil type	Laboratory No. (Cal 50)	Depth	Gravel (>2 mm.)	Sand: Very coarse	Sand: Coarse	Sand: Medium	Sand: Fine	Sand: Very fine	Sand: Total (2 mm. to 0.05 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Toomes rocky loam	5–1	0–1	11.1						35.6
	5–2	1–11	11.3						33.5
Traver sandy loam	39–1	0–7		2.4	7.2	9.6	23.4	18.2	60.8
	39–2	7–23		2.1	5.6	14.1	29.2	21.9	72.9
	39–3	23–31		1.6	7.6	11.4	30.6	21.3	72.5
	39–4	31+		2.1	4.1	12.2	30.2	23.0	71.6
Tujunga sand	21–1	0–10		.6	9.1	31.2	41.4	8.8	91.1
	21–2	10–30							94.9
	21–3	30–60							70.1
Waukena fine sandy loam	37–1	0–4		.4	6.2	12.1	26.9	14.4	60.0
	37–2	4–6		.7	3.0	13.8	28.9	18.4	64.8
	37–3	6–14		1.0	4.5	10.9	27.7	14.0	58.1
	37–4	14–24	4.6	.9	2.3	11.3	28.0	15.6	58.1
	37–5	24+	17.2	.2	1.2	4.4	18.5	18.6	42.9
Whiterock silt loam	17–1	0–6	5.4						31.2
	17–2	6–12	100.0						
Whitney fine sandy loam	28–1	0–7		3.0	7.2	6.6	15.2	19.3	51.3
	28–2	7–16							52.5
	28–3	16–31	19.6						55.6
	28–4	31+	100.0						
Wyman loam	27–1	0–6		1.0	3.4	12.2	19.0	17.5	53.1
	27–2	6–11		.7	4.5	10.7	19.0	16.9	57.8
	27–3	11–25		.9	4.8	11.3	18.6	16.0	51.6
	27–4	25–40		.6	2.7	14.4	19.8	17.4	54.9
	27–5	40–60							52.4
Yokohl loam	9–1	0–10							10.4
	9–2	10–16							8.9
	9–3	16–26							7.1
	9–4	26–30							6.8
	9–5	30–37							
	9–6	37–72							20.5
Zaca clay	34–1	0–6		.2	1.0	2.4	6.0	7.0	16.6
	34–2	6–10		.5	1.2	2.6	10.5	13.5	28.3
	34–3	10–16		.0	.0	.3	4.7	11.6	16.6
	34–4	16–30		.2	1.2	3.9	10.5	8.5	24.3
	34–5	30+		.2	1.6	8.3	30.5	21.5	62.1

Table 17.—*Analyses of clay fractions of selected soils*

Soil type	Depth	Kaolinite	Biotite micas	Montmorillonite	Vermiculite	Quartz[1]	Feldspar[1]	Calcium[1] carbonate	Cristobalite[1]
	Inches	*Percent*	*Percent*	*Percent*	*Percent*				
Well drained to imperfectly drained soils from granitic alluvium:									
Delhi sand	0–12	55	10	25		xx	x		
Tujunga sand	0–10	30		60					
	30–60	23		70					
Hilmar loamy sand	0–7	45	18	15	15	xx	x		
	14–21	40	20	20	10	xx	x		
	29–66	20		40	2	x	x	xx	

See footnote at end of table.

analyses of soil samples—Continued

Silt (0.05 mm. to 0.002 mm.)	Clay <0.002 mm.	Clay <0.001 mm.	Bulk density	Moisture retention values: ⅓ atmos.	Moisture retention values: 15 atmos.	Moisture retention values: Moisture equivalent	Moisture retention values: Permanent wilting point	Organic matter	Total nitrogen	Carbon-nitrogen ratio	Reaction	Calcium carbonate	Water-soluble phosphate
Percent	*Percent*	*Percent*	*Gm. per cc.*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*pH*	*Percent*	*P.p.m.*
50. 4	14. 0	11. 0		27. 5	9. 78	26. 0					6. 1		
48. 5	18. 0	12. 0	1. 9	17. 7	6. 08	17. 2	5. 7	0. 932	0. 0310	17. 4	5. 9		0. 28
30. 2	9. 0	5. 0	1. 6	15. 8	4. 41	11. 9			. 0591	10. 2	8. 1	0. 51	1. 51
20. 1	7. 0	3. 0	1. 7	8. 21	2. 27	6. 2			. 0132	10. 2	9. 3	. 51	. 90
17. 5	10. 0	7. 0	1. 7	11. 8	4. 97	6. 2					9. 7	. 51	
19. 4	9. 0	6. 0	1. 7	11. 8	3. 97	6. 1					10. 2	. 74	
5. 9	3. 0	3. 0	1. 3	5. 30	5. 0	6. 0	2. 6				6. 9		. 53
2. 1	3. 0	2. 0	1. 6	4. 18	3. 6	5. 2	2. 3				6. 9		
20. 9	9. 0	7. 0		17. 7	5. 9	15. 4					7. 3	. 20	
32. 0	8. 0	4. 0		19. 3	11. 1	17. 5			. 233	11. 2	5. 9		3. 97
28. 2	7. 0	3. 0	1. 8	9. 8	3. 46	9. 6			. 0302	14. 1	6. 5		1. 56
24. 9	17. 0	12. 0	2. 0	15. 1	5. 32	14. 7			. 0219	10. 9	7. 9	1. 14	
24. 9	17. 0	12. 0	1. 8	18. 7	6. 12	14. 4					8. 5	2. 61	
43. 1	14. 0	7. 0	1. 7	23. 0	3. 86	19. 0					8. 7	. 72	
62. 8	16. 0	10. 0	1. 6	28. 9	6. 26	26. 4		1. 95	. 186	6. 07	6. 2		. 23
32. 7	16. 0	14. 0	1. 7	16. 5	6. 7	15. 1	5. 2				6. 1		. 38
30. 5	17. 0	15. 0	1. 7	14. 7	4. 7	14. 8	5. 1				6. 1		
28. 4	16. 0	13. 0	1. 6			16. 6					6. 3		
28. 9	18. 0	14. 0	1. 7	20. 5	6. 0	18. 0	5. 7	1. 51	. 0812	10. 8	6. 2		. 73
18. 2	24. 0	21. 0	1. 8	23. 0	10. 7	20. 0	8. 2	. 729	. 0478	8. 84	6. 2		. 36
23. 4	25. 0	22. 0	1. 8	23. 7	11. 9	21. 6	9. 1				6. 2		. 19
24. 1	21. 0	18. 0	1. 6	21. 8	10. 1	19. 6					6. 4		
28. 6	19. 0	16. 0	1. 5	19. 4		18. 7					6. 6		
57. 6	32. 0	23. 0	1. 6			23. 0	10. 2	1. 15	. 0630	10. 6	6. 1		
54. 6	36. 5	30. 0	1. 6			23. 2	11. 5	1. 37	. 0445	17. 9	6. 2		
49. 9	43. 0	36. 0	1. 7			27. 4	14. 7	. 563			6. 1		
54. 7	38. 5	32. 0	1. 8			29. 4		. 392			6. 6		
			1. 7								7. 8		
55. 5	24. 0	15. 0	1. 5			26. 6					7. 7		
35. 4	48. 0	41. 0	1. 7	45. 0	28. 8	40. 3		1. 67	. 0932	10. 0	7. 4	. 83	. 13
31. 7	40. 0	35. 0	1. 7	40. 4	23. 6	39. 0		1. 05	. 0678	9. 0	7. 5	3. 4	. 13
63. 4	20. 0	15. 0	1. 3	49. 9	25. 0	41. 5					7. 5	3. 7	
72. 7	23. 0	17. 0	1. 3	50. 7	30. 2						7. 3	4. 4	
29. 9	8. 0	6. 0	1. 5	25. 7	16. 4	21. 5					7. 4	1. 3	

TABLE 17.—*Analyses of clay fractions of selected soils*—Continued

Soil type	Depth	Kaolinite	Biotite micas	Montmorillonite	Vermiculite	Quartz [1]	Feldspar [1]	Calcium [1] carbonate	Cristobalite [1]
	Inches	*Percent*	*Percent*	*Percent*	*Percent*				
Well drained to imperfectly drained soils from granitic alluvium—Continued									
Grangeville very fine sandy loam	7–20	50	10	40					
Whitney fine sandy loam	7–16	15	5	80		x			
Greenfield sandy loam	9–21	30	35	15	1. 5	x			
Oakdale sandy loam	1–13	30	25	35		x			

See footnote at end of table.

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TABLE 17.—*Analyses of clay fractions of selected soils*—Continued

Soil type	Depth	Kaolinite	Biotite micas	Montmorillonite	Vermiculite	Quartz[1]	Feldspar[1]	Calcium carbonate[1]	Cristobalite[1]
		Percent	*Percent*	*Percent*	*Percent*				
Well drained to imperfectly drained soils from granitic alluvium—Continued									
Snelling sandy loam	15–19	55	20	10	10	xxx	x		
	56–79	30	5	20	40	x	x		
Chualar sandy loam	0–6	45	25	15	10	xx	x		
	24–32	40	10	30	10	x	x		
Modesto loam	10–12	25	20	40		x			
Rocklin fine sandy loam	7–9	60	10	15	3	xxx			
	22–28	30	5	50	10	xx	x		
San Joaquin sandy loam	3–10	35	15	20	20				
	19–24	30	10	27	27				
	48 60	25	5	33	17				
Imperfectly drained and poorly drained soils from granitic alluvium:									
Meikle clay	10–24	30		60					
	36 48	30	10	50		x			
Temple silty clay loam	8.5–15	20	10	50	5				
Rossi clay loam	3–11	15	15	50		xx	xx		
Saline-alkali soils from granitic alluvium:									
Traver sandy loam	23–31	30	20	30				x	
Waukena fine sandy loam	4–6	30	20	20	2	xx	xx	x	
Fresno fine sandy loam	5–10	25	25	35		xx	xx	x	
Well-drained soils on old, high terraces; from gravelly alluvium:									
Corning gravelly sandy loam	8–16	[2] 35		60		x			
	39+	[2] 35		60					
Redding gravelly loam	3–12	[2] 30	5	25	25				
	12–18	[2] 25	5	33	17				
Well-drained soils mainly from basic igneous alluvium and partly from andesitic tuff:									
Pentz gravelly loam	3–8	20	5	75					
Hopeton clay loam	11–20	25	5	65	4				
	20–29	25		75					
Raynor clay	15–30	5		90		xxx			xx
	50+	10		90		x			x
Zaca clay	6–10	7		90				xx	x
	30+	5		93				xx	x
Honcut loam	10–26	[2] 20	10	67	3				
Imperfectly drained soils, mainly from basic igneous alluvium:									
Paulsell clay	12–24	25		65		xx	xx		
Bear Creek gravelly clay loam	6–12	10		80					
	36–53	10		80					
Imperfectly drained soil from mixed igneous and sedimentary alluvium:									
Columbia loam	7–12	35	10	50	5	x			

[1] x—faint trace; xx=distinct trace; xxx=definite quantity present.

[2] Halloysite.

Descriptions of Soil Profiles

Following are detailed descriptions of representative profiles of the different soil series in the Eastern Stanislaus Area. The location of each profile is given. The symbols on the left of the profile designate the horizons. Notations of color are shown by combinations of letters and numbers in parentheses, such as (10YR 5/4). In this example 10YR is the hue and 5/4 expresses the value and chroma in hue 10YR. This notation is more precise than the name of the color, which is also given. Except where otherwise indicated, the notation is for dry soil.

Technical terms are defined in the Glossary in the back of the report and in the "Soil Survey Manual" (*20*).

ALAMO CLAY: In a level, depressional area that is cropped to barley; elevation about 200 feet (SW¼SW¼ sec. 27, T. 4 S., R. 11 E., 3 miles northeast of Denair):

Ap—0 to 6 inches, dark-gray (2.5Y 4/1) clay, black (2.5Y 2/1) when moist; weak, medium and coarse, blocky structure; very hard when dry, firm when moist, very plastic and sticky when wet; numerous fine roots; few fine pores; slightly acid (pH 6.5); contains a few pebbles of quartz and quartzite and some coarse quartz sand; abrupt lower boundary, but surface material extends in tongues downward through cracks.

B21—6 to 18 inches, dark-gray (2.5Y 4/1) heavy clay, black (2.5Y 2/1) when moist; strong, coarse and very coarse, blocky structure that forms moderate, very fine, angular blocky structure when exposed and dry; very hard when dry, firm when moist, very plastic and very sticky when wet; common fine roots that decrease markedly with depth; few fine pores; continuous clay films and numerous slickensides; neutral (pH 7.0 to 7.3); clear, smooth lower boundary.

B22g—18 to 20 inches, dark-gray (10 YR 4/1) heavy clay, very dark gray (10YR 3/1) when moist, common, medium and fine, gray and strong-brown mottles (10YR 5/1 and 7.5YR 5/6, moist); moderate, medium and coarse, blocky structure; consistence similar to that of the B21 horizon; few roots and fine pores; continuous clay films; mildly to moderately alkaline and locally slightly calcareous (pH 7.8 to 8.2); very abrupt, slightly wavy lower boundary, with a mat of fine roots.

Cm—20 to 26 inches, yellowish-red (5YR 5/6), indurated iron-silica hardpan, reddish brown (5YR 4/4) when moist; distinct, medium and thin, platy structure in the upper part that becomes weak with depth; very hard when dry or moist; cannot be penetrated by hand auger when moist; few thin seams of lime; no roots; gradual, smooth lower boundary.

C—26 inches +, light-brown (7.5YR 6/5) sandy loam, brown (7.5YR 5/4) when moist; massive to weakly bedded; hard when dry, firm when moist; slightly calcareous in seams; contains quartz, mica, and feldspar that appear only slightly weathered.

AMADOR LOAM: On a 3 percent slope facing south; pronounced mound microrelief; elevation about 300 feet; under grass-forb cover (1 mile north of Warnerville, at the center of sec. 24, T. 2 S., R. 12 E., 50 feet west of road):

A11—0 to 6 inches, light yellowish-brown (10YR 6/4) loam (near silt loam) when dry, dark brown (7.5YR 4/4) when moist; contains some medium and fine gravel; weak, fine, platy structure, essentially massive when dry; slightly hard when dry, friable when moist; few roots, bulblets, and fine pores; very strongly acid (pH 4.7); low organic-matter content; gradual, smooth lower boundary.

A12—6 to 13 inches, similar to A11 horizon but has fine granular structure that is essentially massive when dry; very low organic-matter content; abrupt, irregular lower boundary.

Dr—13 inches +, white (2.5Y 8/1) rhyolitic bedrock, pale olive (5Y 6/3) when moist; has coatings of light brown in cracks; similar to the A12 horizon; the rock is very strongly acid (pH 4.5); fragments of porous pumice imbedded in the finer textured rock in places.

ANDERSON GRAVELLY FINE SANDY LOAM: On a level flood plain of a minor drainageway; elevation 350 feet; under grass-forb cover (NE¼ sec. 24, T. 2 S., R. 12 E., 1½ miles north of Warnerville):

A1—0 to 14 inches, brown (7.5YR 5/3) gravelly fine sandy loam, dark brown (7.5YR 3/3) when moist; very weak, fine, granular structure, but massive when dry; slightly hard when dry, friable when moist; numerous roots and fine pores; medium acid (pH 6.0); gradual, smooth lower boundary.

C1—14 to 24 inches, reddish-brown (5YR 5/4) very gravelly sandy loam, brown (5 YR 4/4) when moist; very weak, fine, blocky structure that is usually masked by gravel; hard when dry, friable when moist; common roots and numerous pores; slightly acid (pH 6.2); gradual, smooth lower boundary.

C2—24 to 60 inches, light reddish-brown (5YR 6/3) gravelly light sandy loam, reddish brown (5YR 4/3) when moist; few, fine, faint, reddish-brown mottles in the lower part (5YR 4/4) when moist; single grain; loose when dry and moist; somewhat stratified with coarse or medium sand and fine sandy loam; slightly acid (pH 6.5); in places underlain by unrelated bedrock.

AUBURN CLAY LOAM: On a 6 percent slope facing south; elevation 350 feet; under grass-forb coverage in range pasture (SE¼ sec. 16, T. 1 N., R. 11 E. in Stockton Area):

A1—0 to 6 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure; hard when dry, friable when moist, plastic and slightly sticky when wet; many fine roots and fine pores; slightly acid (pH 6.3); clear, smooth lower boundary.

B1—6 to 11 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) with thin, patchy clay films when moist; weak, medium, blocky structure; hard when dry, firm when moist, and stickier than A1 horizon when wet; numerous fine and medium pores; slightly acid (pH 6.4); clear, smooth lower boundary.

B2—11 to 17 inches, reddish-brown heavy clay loam similar to that of the B1 horizon but has thin nearly continuous clay films; abrupt, irregular lower boundary.

Dr—17 inches +, slightly weathered greenstone schist (metamorphosed basic igneous rock); shattered in the upper part; bedding planes nearly vertical.

BEAR CREEK CLAY LOAM: On level flood plain of intermitten streams; elevation 300 feet; under grass-forb cover (NE¼ sec. 30, T. 2 S., R. 12 E., on a streambank cut 200 feet south of road from Oakdale to Warnerville, 9½ miles east-southeast of Oakdale):

A1—0 to 6 inches, dark-gray (10YR 4/1) clay loam with some gravel, very dark gray (10YR 3/1) when moist; weak, medium, blocky structure; slightly hard when dry, friable when moist, slightly plastic and slightly sticky when wet; many roots and wormholes; slightly acid (pH 6.1); gradual, smooth lower boundary.

B21—6 to 21 inches, same color as A1 horizon; sandy clay loam with some gravel; moderate, medium, angular blocky structure; slightly hard when dry, friable when moist, plastic and sticky when wet; thin discontinuous clay films on ped surfaces and in pores; many fine and some medium pores; slightly acid (pH 6.4); gradual, smooth lower boundary.

B22g—21 to 36 inches, dark-gray, faintly mottled, cobbly sandy clay loam; similar to B21 horizon, but has weak, medium, blocky structure to massive; thin patchy clay films; neutral (pH 6.6); clear, smooth lower boundary.

Cg—36 to 53 inches, dark-brown (7.5YR 4/2) very gravelly sandy loam, dark brown (7.5YR 3/2) when moist; massive; medium mottles of strong brown (7.5YR 5/6, dry) and yellowish brown (10YR 5/4, dry); slightly hard when dry, friable when moist; neutral (pH 6.9); abrupt lower boundary.

D—53 inches+, unrelated, andesitic, bluish-gray tuff.

CHUALAR SANDY LOAM: On level alluvial fan planted to a vineyard; elevation, 90 feet (NE¼NE¼SE¼ sec. 21, T. 3 S., R. 8 E., 4 miles west of Modesto, 100 yards south of Blue Gum Avenue on west side of Clark Avenue):

A1p—0 to 6 inches, grayish-brown (10YR 5/2) light sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; soft when dry, very friable when moist; porous; moderate, fine roots; strongly acid (pH 5.5);[7] abrupt, wavy lower boundary.

A11 6 to 14 inches, grayish-brown (10YR 5/2) sandy loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard when dry, very friable when moist; porous; moderate number of fine roots; slightly acid (pH 6.1); gradual, smooth lower boundary.

A12—14 to 24 inches, sandy loam, same color as A11 horizon but a few, faint, fine mottles of dark grayish brown (10YR 4/2, moist); massive; slightly hard when dry, friable when moist; porous; slightly acid (pH 6.2); clear, smooth lower boundary.

B1—24 to 32 inches, brown (10YR 5/3) heavy sandy loam, dark brown (7.5YR 3/2 and 10YR 3/3) when moist; very weak, medium, blocky structure; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; thin patchy clay films on ped surfaces and in pores; slightly acid (pH 6.2); clear, smooth lower boundary.

B2—32 to 48 inches, sandy clay loam, same color as B1 horizon, but a few fine mottles of yellowish red (5YR 5/6) and very dark gray (10YR 3/1, moist); weak, medium, blocky structure; hard when dry, firm when moist, plastic and slightly sticky when wet; moderately porous; thin continuous clay films on peds and in pores and on sand grains; slightly acid (pH 6.5); gradual, smooth lower boundary.

B3—48 to 58 inches, yellowish-brown (10YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; few fine mottles of strong brown (7.5YR 5/6) moist; massive; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; slightly acid (pH 6.5); gradual, smooth lower boundary.

C—58 to 72 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; few mottles; massive; soft when dry, very friable when moist; neutral (pH 6.7); underlain in places by unrelated beds of compact silt loam.

COLUMBIA LOAM: On a flood plain of the San Joaquin River, and protected by levees; elevation 40 feet; under grass-forb vegetation; (SW¼ sec. 14, T. 5 S., R. 8 E., 4½ miles northeast of Patterson, 0.2 mile east of Jennings Road, 0.26 mile north of West Main Street):

A1—0 to 13 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; few, medium, strong-brown mottles (7.5YR 5/6, dry); very weak blocky structure to massive; slightly hard when dry, friable when moist; slightly stratified; many roots and fine and coarse pores; acid (pH 6.5); diffuse lower boundary.

C—13 to 60 inches +, light brownish-gray (10YR 6/2), stratified fine sandy loam, loamy fine sand, and silt loam, dark grayish brown (10YR 4/2) when moist; distinct, common, medium and coarse mottles of strong brown (7.5YR 5/6, dry); massive; soft when dry, very friable when moist; neutral (pH 6.9, decreasing gradually to about 6.5).

[7] Abnormally acid because of use of acidic fertilizers and insecticides.

CORNING GRAVELLY SANDY LOAM: On a 5 percent slope facing south; elevation 300 feet; under grass-forb range pasture (¼ mile north-northwest of windmill in the SW¼ sec. 11, T. 4 S., R. 13 E.):

A1—0 to 8 inches, brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; numerous roots and medium and fine pores; slightly acid (pH 6.3); clear, smooth lower boundary.

A3—8 to 16 inches, brown (7.5YR 5/3) gravelly sandy loam, reddish brown (5YR 4/3) when moist; weak, fine, blocky to fine granular structure; hard when dry, friable when moist, slightly sticky when wet; some roots; numerous fine and medium pores; pebbles somewhat weathered; thin patchy clay films on ped surfaces; medium acid (pH 5.9); clear, wavy lower boundary.

B2—16 to 26 inches, yellowish-red (5YR 4/6) sandy clay with a little gravel, reddish brown (5YR 4/4) when moist; massive; very hard when dry, firm when moist, plastic and sticky when wet; thin continuous clay films slightly redder than interior of peds; medium acid (pH 5.6); gradual, smooth lower boundary.

B3—26 to 39 inches, gravelly sandy clay loam; same color as B2 horizon; massive; same consistence as B2 horizon; pebbles strongly weathered; slightly acid (pH 6.1); diffuse lower boundary.

C—39 inches +, yellowish-red (5YR 4/6) gravelly sandy loam, reddish brown (5YR 4/5) when moist; massive; hard when dry, friable when moist, very slightly sticky when wet; pebbles slightly weathered; slightly acid (pH 6.1); contains a mixture of granitic and metamorphic sand and gravel, including vein quartz, quartzite, slate, and schist.

DELHI SAND: In a railroad cut on a 2 percent slope; elevation 100 feet; idle area under grass-forb vegetation (sec. 20, T. 2 S., R. 9 E., railroad cut just east of Del Rio Country Club, 7 miles north of Modesto):

C1—0 to 60 inches, light brownish-gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist; common roots throughout; faint cross-bedding visible in the lower part; a few streaks of organic matter in the upper foot; neutral (pH 6.6, decreasing to 6.4 with depth).

DINUBA SANDY LOAM: In a level, irrigated alfalfa field; elevation 125 feet (north side of Coelho Road, ⅛ mile west of center of sec. 35, T. 4 S., R. 10 E.):

A1p—0 to 8 inches, grayish-brown (2.5Y 5/2) sandy loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, granular structure, but essentially massive when dry; slightly hard when dry, friable when moist; numerous fine roots and pores; neutral to slightly acid (pH 6.6 to 6.2); gradual, smooth lower boundary.

B1g—8 to 18 inches, light brownish-gray (10YR 6/2) sandy loam with common fine mottles of strong brown (7.5YR 5/6, moist), dark grayish brown (10YR 4/2) when moist; massive; slightly hard when dry, friable when moist; common fine roots and few fine pores; few thin clay films on sand grains; slightly acid (pH 6.3); gradual, smooth lower boundary.

B2g—18 to 28 inches, similar to B1g horizon but is heavy sandy loam and has slightly less mottling; intermittently slightly calcareous in the lower part of layer; a few thin clay films in pores and on sand grains; slightly acid (pH 6.4); abrupt, slightly broken lower boundary.

D1g—28 to 36 inches, white (10YR 8/1), slightly stratified silt loam and very fine sandy loam with common fine mottles and streaks of strong brown (7.5YR 5/6), light gray (10YR 6/1) when moist; weak, thin, platy (bedded) structure; hard when dry, firm and slightly brittle when moist; few, fine, soft segregations of lime; very few roots; slightly acid (pH 6.3); gradual, smooth lower boundary.

D2g—36 to 60 inches +, similar to D1 horizon but very firm and brittle when moist and contains a considerable amount of segregated lime in seams and a little lime disseminated throughout; lime decreases gradually with depth; moderately alkaline (pH 8.2); water table is usually at a depth of less than 6 feet.

Exchequer Rocky Loam: On a slope of 11 percent facing southeast; elevation 350 feet; under a grass-oak vegetation; (sec. 7, T. 3 S., R. 14 E., 0.65 mile south of the Tuolumne County line, on the highway from La Grange to Sonoma):

A1—0 to 13 inches, reddish-brown (5YR 5/4) rocky loam, reddish brown (5YR 5/4) when moist; frequent tombstonelike outcrops of vertically bedded schist; weak, fine, granular structure that dries to massive; hard when dry, friable when moist, slightly plastic and nonsticky when wet; moderately low in content of organic matter; abrupt, irregular lower boundary.

Dr—13 inches +, hard greenstone with nearly vertical bedding planes; thin reddish-brown (5YR 5/4, dry) clay films on weathered rock surfaces.

Fresno Fine Sandy Loam: On a level area that is broken by mound microrelief; elevation 50 feet; range under grass and salt-tolerant plants (½ mile west of the west end of Keyes Road, southeast of Grayson):

A1—0 to ¼ inch, dark-gray (10YR 4/1) fine sandy loam, black (10YR 2/1) when moist; very weak, very fine, granular structure; soft when dry, very friable when moist; numerous saltgrass stolens and fine roots; partly decomposed organic matter; abrupt, smooth lower boundary.

A2—¼ inch to 5 inches, light brownish-gray (nearly light gray) (10YR 6/2) fine sandy loam, dark gray (10YR 4/1) when moist; common fine (apparently organic) mottles of dark brown (10YR 4/3); moderate, medium, platy structure; slightly hard when dry, friable when moist; medium number of saltgrass stolens and fine roots; a few fine pores; noncalcareous; neutral (pH 6.9); very abrupt, smooth lower boundary.

B21—5 to 10 inches, grayish-brown (10YR 52), sandy clay loam, dark grayish brown (10YR 4/2); strong, coarse, prismatic structure; very hard when dry, friable when moist, plastic and very sticky when wet; moderate number of clay films continuous on horizontal and vertical ped surfaces; few roots and saltgrass stolens; strongly alkaline (pH 8.8); few, soft, lime concretions; gradual, smooth lower boundary.

B22—10 to 18 inches, light brownish-gray (2.5Y 6/2) loam, light olive brown (2.5Y 5.5/4) when moist; moderate, coarse, blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few roots and saltgrass stolens; clay films as in B21 horizon but thinner; few seams of segregated lime; very strongly alkaline (pH 9.7); gradual, irregular lower boundary.

B3g—18 to 38 inches, light-gray (2.5Y 7/1) silt loam, olive gray (5Y 4/2) when moist; common, prominent, brown mottles (7.5YR 5/4, dry; 4/4, moist) in the lower 9 inches; moderate, medium, angular blocky structure; hard when dry, firm when moist (weakly cemented layers in the lower part), slightly plastic and slightly sticky when wet; thin continuous clay films; slightly calcareous, with disseminated lime; very strongly alkaline (pH 9.8); abrupt, wavy lower boundary.

Cm—38 to 40 inches, light-gray (5Y 7/2) lime-silica cemented hardpan, olive gray (5Y 5/2) when moist; massive; strongly calcareous; abrupt, wavy lower boundary.

C—40 inches +, light-gray (5Y 7/2) loam, olive gray (5Y 5/2) when moist; massive; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; strongly calcareous; few patchy clay films; stratified in places; very strongly alkaline (pH 9.3).

Grangeville Very Fine Sandy Loam: On a nearly level alluvial flood plain; under irrigated grass pasture (SE¼ sec. 34, T. 3 S., R. 10 E., on the north side of the Tuolumne River, 2 miles east and 1 mile south of Empire):

A1—0 to 7 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, friable when moist; numerous roots and many fine pores; neutral (pH 7.3); diffuse lower boundary.

C1g—7 to 40 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) when moist; stratified with slightly coarser and finer layers; few fine and medium mottles of strong brown (7.5YR 5/6, dry; 4/6, moist); soft when dry, friable when moist; numerous roots and fine pores; mildly alkaline (pH 7.5); diffuse lower boundary.

C2g—40 inches +, very fine sandy loam similar to C1 horizon but is faintly mottled and contains disseminated lime; mildly alkaline (pH 7.6).

Greenfield Sandy Loam: In nearly level grass-forb range pasture; elevation 200 feet (center of sec. 13, T. 3 S., R. 11 E., in deep gully at edge of uncultivated terrace overlooking Dry Creek):

A11—0 to 9 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure that dries to massive; soft when dry, friable when moist; many fine roots and medium and fine pores; neutral (pH 6.8); gradual, smooth lower boundary.

A12—9 to 21 inches, brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) when moist; similar to A11 horizon but slightly hard when dry: neutral (pH 6.8); clear, smooth lower boundary.

B2—21 to 42 inches, brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) when moist; slightly more clay than in the A11 and A12 horizons (14 percent as compared to 11 percent in the surface horizon); weak, medium to coarse, blocky structure that crushes to weak granular; hard when dry, friable when moist, very slightly plastic when wet; moderate roots slightly concentrated in cracks; many medium and fine pores; thin patchy clay films in pores and on sand grains; neutral (pH 6.8); diffuse lower boundary.

C1—42 to 52 inches, pale-brown (10YR 6/3) sandy loam (9 percent clay), brown (10YR 4/3) when moist; very similar to B2 horizon except for a few thin clay films; neutral (pH 7.0); slightly hard when dry, friable when moist; gradual, smooth lower boundary.

C2—52 inches +, light sandy loam (7 percent clay), same color as C1 horizon; massive; soft when dry, friable when moist; slightly stratified with very fine sandy loam; few roots and a few fine pores; neutral (pH 7.0); underlain in some places by white, stratified, compact silt and very fine sand.

Hanford Sandy Loam: In a nearly level, irrigated peach orchard at an elevation of 125 feet (SW¼SW¼ sec. 15, T. 4 S., R. 10 E., west side of Atchison, Topeka, and Santa Fe Railway, 0.45 mile southeast of Hughson):

Ap—0 to 12 inches, light brownish-gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) when moist; weak, fine, granular structure, essentially massive when dry; slightly hard when dry, friable when moist; many fine roots and fine pores; sand grains are fresh and angular and are of quartz, unweathered feldspar, and mica; slightly acid (pH 6.1); gradual, smooth lower boundary.

C—12 to 60 inches +, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; massive; soft when dry, friable when moist; numerous roots and fine pores; neutral; pH increases slightly with depth (pH 6.5 to 6.8).

Hilmar Sand in level, idle, irrigated cropland; elevation 80 feet (⅛ mile south of west quarter corner of sec. 36, T. 5 S., R. 9 E., ⅝ mile south of Mitchell School, 6 miles southwest of Turlock):

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) when moist; a few organic streaks or places of grayer color; massive; soft when dry, very friable when moist; numerous roots; very porous and permeable; slightly acid (pH 6.5); clear, smooth lower boundary.

C11—7 to 14 inches, similar to Ap horizon but has a few fine mottles of yellowish brown (10YR 5/4) when moist; neutral (pH 7.0); gradual, smooth lower boundary.

C12—14 to 21 inches, loamy sand similar to C11 horizon but mildly alkaline (pH 7.4); clear, smooth lower boundary.

C3g—21 to 29 inches, light olive-brown (2.5Y 5/3), olive brown (2.5Y 4/3) when moist; many, distinct, dark-brown (7.5YR 4/4, moist) mottles; stratified sandy loam and loamy sand; massive; slightly hard when dry, friable when moist; common fine pores and roots; strongly calcareous, with some soft segregations; moderately alkaline (pH 8.0); somewhat broken lower boundary.

D—29 to 66 inches, light-gray (5Y 7/2), stratified silt loam and sandy loam, olive (5Y 5/3) when moist; fine platy bedding; hard when dry, firm when moist; strongly alkaline (pH 8.6) and strongly calcareous; seams in the upper part contain segregated lime, and amount of lime decreases with depth; water table at a depth of 66 inches.

HONCUT LOAM on a nearly level flood plain; elevation 150 feet; under grass-forb range (SE¼ sec. 16, T. 3 S., R. 11 E., 2 miles north of Waterford, north side of Dry Creek):

A1—0 to 10 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; very weak, coarse, blocky structure; hard when dry, friable when moist, slightly plastic and nonsticky when wet; many fine roots and fine pores; slightly acid (pH 6.3); gradual, smooth lower boundary.

C1—10 to 26 inches, brown (10YR 5/3), light sandy clay loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, slightly plastic and nonsticky when wet; common roots and many fine pores; slightly acid (pH 6.3); gradual, smooth lower boundary.

C2—26 inches +, brown (10YR 5/3), slightly stratified, heavy sandy loam, dark brown (10YR 3/3) when moist; material slightly coarser with depth; slightly hard when dry, friable when moist; slightly acid (pH 6.5).

HOPETON CLAY LOAM: On a 5 percent slope that faces east; under grass-forb range that was formerly in dry-farmed grain (4½ miles east of Hickman, 100 feet north of the road from Hickman to La Grange, just north of the center of sec. 5, T. 4 S., R. 12 E.):

A1—0 to 11 inches, between dark-gray and dark-brown (7.5YR 4/1 and 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium to coarse blocky structure that tends toward fine granular at the immediate surface; hard when dry, friable when moist, plastic and slightly sticky when wet; many fine roots and fine pores; medium acid (pH 5.9); clear, smooth lower boundary.

B21—11 to 20 inches, dark-gray (5YR 4/1) clay, dark reddish brown (5YR 3/2) when moist; moderate, medium, prismatic structure; very hard when dry, firm when moist, very plastic and sticky when wet; some fine roots and fine pores; moderate number of continuous clay films on ped surfaces; neutral (pH 6.8); diffuse lower boundary.

B22—20 to 29 inches, clay loam between dark-gray and dark-brown (7.5YR 4/1 and 4/2), dark brown (7.5YR 3/2) when moist; moderate, medium, blocky structure; hard when dry, friable to firm when moist, plastic when wet; thin continuous clay films on ped surfaces; few roots and fine pores; mildly alkaline (pH 7.5); gradual, smooth lower boundary.

B3—29 to 38 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) when moist; massive; slightly hard when dry, friable when moist, slightly plastic when wet; very few roots but numerous fine pores; thin patchy clay films; mildly alkaline (pH 7.7), with a few hard specks of segregated lime; abrupt, wavy lower boundary.

Dr—38 inches +, light-gray (10YR 6/1), weakly consolidated sandstone, dark brown (7.5YR 4/2) when moist; weakly platy in the upper few inches, but becomes massive below; a few thin seams of lime that decrease in number with depth.

HORNITOS FINE SANDY LOAM: On a 7 percent slope that faces west; under grass-forb oak range pasture; elevation 300 feet (NW¼SW¼ of sec. 35, T. 2 S., R. 13 E., 2½ miles southeast of Copperstown, on the La Grange Road):

A1—0 to 7 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) when moist; very weak granular structure that dries to massive; slightly hard when dry, friable when moist; many roots and fine pores; medium acid (pH 5.9); abrupt, irregular lower boundary.

Dr—7 inches +, pink (10R 7/2), reddish-yellow (7.5YR 6/6), and white (10YR 8/1), moderately consolidated sandstone that consists of stable minerals, mainly quartz and kaolin, and secondary minerals, such as anauxite; partly weathered in the upper inch.

KEYES COBBLY CLAY LOAM: On a nearly level high terrace with pronounced microrelief; under grass-forb range pasture; elevation 500 feet (southwest corner of sec. 4, T. 2 S., R. 12 E., ⅛ mile north of Hetch Hetchy aqueduct, in a fresh roadcut about 5 miles southwest of Knights Ferry, on the Williams Ranch):

A1—0 to 3 inches, grayish-brown (10YR 5/2) cobbly clay loam (near loam), very dark grayish brown (10YR 3/2) when moist; weak, fine, granular to very weak, fine, blocky structure that dries to massive; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; numerous fine roots and fine pores; moderately low in organic matter; large cobbles are scattered thickly over the surface in intermound areas, but gravel predominates in the mounds; medium acid (pH 5.8); clear, smooth lower boundary.

B1—3 to 8 inches, grayish-brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, blocky structure; hard when dry, friable when moist, slightly more plastic and sticky than the A1 horizon; fewer roots and fine pores than in the A1 horizon; more medium gravel than in the upper 3 inches of this soil; few thin patchy clay films; slightly acid (pH 6.2); gradual, smooth lower boundary.

B21—8 to 12 inches, same color as B1 horizon; gravelly clay loam; moderate, medium, blocky structure obscured by the gravel content; hard when dry, friable to firm when moist, plastic and sticky when wet; few roots and pores; thin continuous clay films on peds; slightly acid (pH 6.4); abrupt, smooth lower boundary.

B22—12 to 16 inches, gravelly clay, same color as B21 horizon; high content of gravel obscures structure; gravel is strongly weathered and can be broken apart into thin, concentric shells; hard, very firm, very plastic and very sticky; thick continuous clay films on peds and in pores; medium acid (pH 6.0); abrupt, slightly wavy lower boundary.

Cm—16 to 30 inches, yellowish brown (10YR 5/4), indurated iron-silica hardpan that encloses considerable gravel and resembles conglomerate, dark yellowish brown (10YR 4/4), when moist; slightly platy in the upper part; can be broken only with difficulty by pick and bar; gradual, smooth lower boundary.

C—30 inches +, very weakly consolidated, andesitic gravel that has a little sandy loam material in the interstices; stratified with bluish-gray, andesitic sands

and beds of tuff; gravel beds are 10 to 30 feet thick and are underlain by beds of finer textured, andesitic tuff.

Madera Sandy Loam: In a nearly level, irrigated vineyard; elevation 150 feet (100 feet west of center of sec. 2, T. 3 S., R. 9 E., southeast of intersection of old Oakdale Road and Claribel Road):

Ap—0 to 9 inches, brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) when moist; massive; hard when dry, friable when moist, slightly sticky when wet; numerous roots and fine pores; neutral (pH 7.0); gradual, smooth lower boundary.

B1—9 to 19 inches, brown (7.5YR 5/3) sandy loam, dark reddish brown (5YR 3/3) when moist; weak, medium and coarse, blocky structure that breaks to weak, medium, granular; hard when dry, friable when moist, slightly sticky when wet; common roots and fine pores; thin patchy clay films on grains and surfaces; neutral (pH 7.0); gradual, smooth lower boundary.

B2—19 to 28 inches, reddish-brown (5YR 5/3) sandy clay, reddish brown (5YR 4/3) when moist; moderate, medium and coarse, blocky structure; very hard when dry, friable when moist, plastic and sticky when wet; common roots and fine pores; thick continuous clay films; neutral (pH 7.0); gradual, smooth lower boundary.

B3—28 to 30 inches, brown (7.5YR 5/4) heavy sandy loam, mottled yellowish brown and dark brown (10YR 5/4) and 7.5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky when wet; few roots; common fine pores; very abrupt, wavy lower boundary.

Cm—30 to 36 inches, brown (10YR 5/3) indurated hardpan, dark brown (10YR 4/3) when moist; has silica and iron oxides and numerous, small, dark spots and concretions of maganese oxide; thin lime seams in the lower part; gradual, smooth lower boundary.

C—36 inches +, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly stratified; very hard when dry, firm when moist; few thin seams of lime; mildly alkaline (pH 7.7); spots of dark, segregated manganese oxide in the upper part.

Meikle Clay: In a gully bank in nearly level dry pasture next to irrigated pasture (1,400 feet east and 1,600 feet north of the southwest corner of sec. 18, T. 3 S., R. 12 E., 3 miles east and 2 miles north of Waterford):

A1—0 to 4 inches, gray (10YR 6/1) sandy clay loam, very dark gray (10YR 3/1) when moist; faintly mottled; massive when moist but blocky when dry; blocks 6 to 12 inches across; large cracks 1 to 1½ inches wide, and a matrix of fine cracks give the surface of this horizon a very fine blocky structure; very hard, firm, plastic and slightly sticky; numerous fine roots and fine pores; medium acid (pH 6.0); abrupt, smooth lower boundary.

B21—4 to 16 inches, dark-gray (10YR 4/1, dry and moist) clay; strong, medium, blocky structure; very hard when dry, firm when moist, and sticky and plastic when wet; few roots and fine pores; moderately thick continuous gray clay films on all ped faces; few manganese concretions, 1 to 3 millimeters in diameter; neutral (pH 6.8); gradual, smooth lower boundary.

B22—16 to 24 inches, dark-grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/) when moist; strong, medium, subangular blocky to blocky structure; very hard when dry, very firm when moist, and very sticky and plastic when wet; few roots and fine pores; moderately thick continuous dark colloidal films on all ped faces; few manganese and iron concretions and lime in specks and in small, soft concretions, ½ to 1 millimeter in diameter; mildly alkaline (pH 7.7); clear, smooth lower boundary.

B3ca—24 to 36 inches, brown (10YR 5/3) sandy clay loam, dark brown (7.5YR 4/2) when moist; strong, medium, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; few fine roots; thin continuous clay films on ped faces; common iron and manganese concretions; mildly alkaline (pH 7.7); lime in seams and small blotches; gradual, smooth lower boundary.

C1—36 to 48 inches, pale-brown (10YR 6/3) light sandy clay loam, dark brown (10YR 4/3) when moist; weak, medium, blocky structure to massive; slightly hard, friable; neutral (pH 7.2); noncalcareous; gradual, smooth lower boundary.

C2—48 to 60 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable; noncalcareous; neutral (pH 7.7); this horizon contains much mica, quartz, and feldspar.

Modesto Loam: In a nearly level, urbanized area that was formerly irrigated pasture (660 feet west and 300 feet north of the east quarter corner of sec. 17, T. 3 S., R. 9 E., 2½ miles north of Modesto, ⅛ mile west of McHenry Avenue, 300 feet north of Bowen Avenue):

A1p—0 to 10 inches, grayish brown (10YR 5/2) loam (somewhat gritty), very dark grayish brown (10YR 3/2) when moist; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few pores; numerous fine roots; medium acid (pH 5.8); abrupt, smooth lower boundary.

B1 10 to 12 inches, light sandy clay loam, between grayish brown and brown (10YR 5/2 and 5/3); very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, blocky structure; very hard when dry, firm when moist, plastic and slightly sticky when wet; slightly acid (pH 6.1); this layer may have been somewhat mixed by leveling or cultivation.

B21—12 to 25 inches, brown (10YR 5/3) light clay, dark brown (10YR 4/3) when moist; dark-brown (7.5YR 3/2) coatings; moderate, coarse, prismatic to strong, coarse, angular blocky structure in the lower part; very hard when dry, firm when moist, plastic and sticky when wet; thick continuous clay films on all ped faces; slightly acid (pH 6.3); clear, smooth lower boundary.

B22—25 to 35 inches, brown (10YR 5/3) heavy sandy clay loam, dark brown (10YR 4/3) when moist; coatings of dark gray (7.5YR 4/1, dry) and very dark brown (7.5YR 2/2, moist); similar to B21 horizon but neutral (pH 6.7); gradual, smooth lower boundary.

B31—35 to 44 inches, brown (10YR 5/3) heavy sandy loam, dark brown (7.5YR 3/2) when moist; very weak, coarse, blocky structure; hard when dry, friable when moist, plastic and slightly sticky when wet; thin clay films on vertical faces; neutral (pH 6.8); gradual, smooth lower boundary.

B32—44 to 55 inches, brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) when moist; massive to very weak blocky structure; few thin patchy clay films; neutral (pH 6.8); abrupt, irregular lower boundary.

D—55 inches +, light-gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) when moist; common, medium, distinct mottles of yellowish brown (10YR 5/6, dry and moist); massive; hard when dry, firm when moist, slightly plastic when wet; neutral (pH 7.3); stratified with very fine sandy loam in places.

Montpellier Coarse Sandy Loam: On a 15 percent slope facing north; elevation 315 feet; under grass-forb vegetation (SE½ sec. 36, T. 3 S., R. 12 E., north side of Turlock Lake (reservoir) near top of hill):

A1—0 to 8 inches, brown (7.5YR 5/3) coarse sandy loam, dark brown (7.5YR 3/3) when moist; weak, fine, granular structure, essentially massive when dry; slightly hard when dry, friable when moist; many fine roots and fine pores; about 2 percent of the soil is sharp, angular, very fine grained gravel, 2 to 3 millimeters in diameter; slightly acid (pH 6.4); gradual, smooth lower boundary.

A3—8 to 18 inches, similar to A1 horizon but slightly higher in clay content in the lower part; the ratio of <1 micron to <2 micron clay is about 0.75 in both horizons; clear, smooth lower boundary.

B21 18 to 27 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; weak, coarse, prismatic structure to massive; very hard when dry, firm when moist, plastic and sticky when wet; medium acid (pH 5.8); few roots and few fine pores; thick continuous clay films on sand grains and in pores; most pores are filled with clay; ratio of <1 micron to <2 micron clay is 0.93; gradual, smooth lower boundary.

B22—27 to 39 inches, similar to B21 horizon but common, medium, distinct mottles of pinkish gray (5YR 6/2, moist); massive; ratio of <1 micron to <2 micron clay is 0.96; clear, smooth lower boundary.

B3—39 to 45 inches, reddish-brown (2.5YR 5/4) coarse sandy clay loam mottled like B22 horizon; reddish brown (2.5YR 4/4) when moist; massive; hard when dry, firm when moist, sticky and slightly plastic when wet; few pores; clay films are on sand grains but decrease with depth; neutral (pH 7.0); diffuse lower boundary.

C—45 inches +, similar to B3 horizon but coarse sandy loam without mottling; massive; hard, friable, nonplastic and slightly sticky; somewhat stratified with coarser and finer sandy loams; neutral (pH 7.2).

Oakdale Sandy Loam: In a nearly level pasture under grass-oak vegetation; elevation 150 feet (2 miles east of Riverbank on the south side of the Oakdale Highway, 50 feet east of Langworth Road in a native oak grove used for pasture):

A0—1 inch to 0, dark grayish-brown (10YR 4/2) sandy leaf mold; granular; soft; neutral (pH 7.0).

A1—0 to 13 inches; grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; very weak platy structure, essentially massive when dry; slightly hard when dry, friable when moist; many roots and medium and fine pores; neutral (pH 6.8); gradual, smooth lower boundary.

A3—13 to 25 inches, brown (10YR 5/3) sandy loam slightly heavier than A1 horizon, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist; numerous fine roots and fine pores; neutral (pH 7.0); clear, smooth lower boundary.

B2—25 to 38 inches; dark-brown (7.5YR 4/3) heavy sandy loam, dark brown (10YR 3/3) when moist; massive; hard when dry, friable when moist, slightly plastic when wet; few light-gray coatings in cracks; thin continuous clay films on sand grains and in pores; neutral (pH 6.9); gradual, smooth lower boundary.

B3—38 to 45 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist; few old roots; few thin patchy clay films; neutral (pH 6.8); diffuse lower boundary.

C—45 inches +, brown (10YR 5/3) loamy sand with a little gravel, dark brown (10YR 4/3) when moist; massive; soft when dry, friable when moist but becomes softer with depth; few fine mottles of strong brown; neutral (pH 6.9); becomes more stratified with depth.

Paulsell Clay: In a nearly level streambank cut that is used for rice and irrigated pasture (500 feet east and 100 feet north of the west quarter corner of sec. 31, T. 2 S., R. 12 E., near Paulsell Station on the Sierra Railroad):

A11—0 to 12 inches, dark-gray (5YR 4/1) clay, very dark gray (5YR 3/1) when moist; moderate, very coarse, blocky structure that dries to medium and fine granular on the immediate surface; hard when dry, firm when moist, very plastic when wet, sticky; many fine roots and fine pores; slightly acid (pH 6.2); gradual, smooth lower boundary.

A12—12 to 24 inches, dark-gray (5YR 4/1) clay, very dark gray (5YR 3/1) when moist; similar to A11 horizon but has moderate, coarse, blocky structure; moderate number of fine roots and a few fine pores; few, small, round, purplish-black manganese concretions in the lower part; slickensides numerous; neutral (pH 7.0); gradual, smooth lower boundary.

A13Ca—24 to 36 inches, clay between dark-gray (5YR 4/1) and dark reddish-gray (5YR 4/2), very dark gray (5YR 3/1) to dark gray (5YR 4/1) when moist; similar to A12 horizon but mildly alkaline (pH 7.6); small spots and nodules of segregated lime and fairly numerous, small, round, purplish-black manganese concretions; slickensides common; becomes more friable with depth; clear, smooth lower boundary.

C1Ca—36 to 50 inches, pale-brown (10 YR 6/3) heavy fine sandy loam, dark brown (10YR 4/3) when moist; weak, medium to fine, blocky structure that tends toward platiness; slightly hard when dry, friable when moist, plastic and slightly sticky when wet; in places weakly cemented but usually crushes easily between the fingers; few specks and seams of segregated lime; neutral (pH 7.3); diffuse lower boundary.

C2—50 to 75 inches +, pale-brown (10YR 6/3), stratified fine sandy loam and clay loam; massive; underlain by stratified sand and gravel.

Pentz Gravelly Loam: On a 10 percent slope that faces south; elevation 250 feet; under grass-forb range pasture (SW¼ sec. 29, T. 2 S., R. 12 E., ⅜ mile east of Tim Bell Road, 100 feet south of road cut in Oakdale-Warnerville Road):

A1—0 to 3 inches, grayish-brown (10YR 5/2) gravelly loam with a few cobbles as much as 4 inches in diameter, dark brown (7.5YR 3/2) when moist; weak, medium, blocky structure; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; many fine roots; few pores; medium acid (pH 5.7); clear, smooth lower boundary.

A12—3 to 8 inches, gravelly sandy loam, between brown (7.5YR 5/2) and dark brown (7.5YR 4/2), dark brown (7.5YR 3/2) when moist; moderate, medium, blocky structure; hard when dry, firm when moist, slightly plastic and slightly sticky when wet; very few thin patchy clay films; numerous fine roots and fine pores; slightly acid (pH 6.3); abrupt, slightly broken lower boundary.

Dr—8 inches +, brown (10YR 5/3), weakly consolidated mudstone, dark brown (10YR 3/3) when moist; contains mainly andesitic tuff.

Peters Clay: On a 7 percent slope that faces west; elevation is 420 feet; under grass-forb range (⅛ mile north of center of sec. 9, T. 2 S., R. 12 E., about 4 miles southeast of Knights Ferry):

A11—0 to 8 inches, dark-gray (10YR 4/1) clay, black (10YR 2/1) when moist; strong, coarse, blocky structure that dries to fine and medium granular on the immediate surface; very hard when dry, firm when moist, very plastic and sticky when wet; many fine roots and pores; contains some rounded gravel; slightly acid (pH 6.1); gradual, smooth lower boundary.

A12—8 to 16 inches, similar to A11 horizon but has moderate, coarse, blocky structure and tends toward a predominance of vertical cracks; slightly acid (pH 6.4); abrupt, wavy to smooth lower boundary.

Dr—16 inches +, stratified andesitic sediments that include sandstone, mudstone, and andesitic conglomerate; generally moderately consolidated, but strata of loose sands occur in places; the upper surface is speckled tan and brown in places, but the characteristic color of the material is bluish gray; in places the upper ⅛ to ¼ inch is slightly harder than the material below.

Raynor Clay: On a 2 percent slope that faces south in a field used occasionally for dry-farmed barley; elevation 275 feet (⅜ mile west of the northeast corner of sec. 27, T. 2 S., R. 11 E.):

A11—0 to 15 inches, dark-gray (5YR 4/1) clay, very dark gray (5YR 3/1) when moist; strong, very coarse, blocky structure that dries to strong, fine, granular

on the immediate surface; very hard when dry, firm when moist, very plastic and sticky when wet; numerous roots; few fine pores; medium acid (pH 5.8); gradual, smooth lower boundary.

A12—15 to 30 inches, clay, same color as A11 horizon; strong, medium and coarse, blocky structure; very hard when dry, firm when moist, very plastic and very sticky when wet; numerous slickensides; few fine mottles of strong brown; grass straw in seams; some fine roots; moderate fine pores; slightly acid (pH 6.5); gradual, wavy lower boundary.

A13—30 to 39 inches, dark-gray (5YR 4/1) clay, similar to A12 horizon except for strong, medium, blocky structure; neutral (pH 7.1); clear, wavy lower boundary.

Cca—39 to 50 inches, brown (7.5YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, blocky structure; hard when dry, firm when moist, very plastic and sticky when wet; few roots; many fine pores; slightly calcareous with soft blotches and few, fine, hard nodules of segregated lime; mildly alkaline (pH 7.5); abrupt, wavy lower boundary.

Dr—50 inches +, speckled light gray (10YR 7/2) andesitic tuff, grayish brown (10YR 5/2) when moist; massive; very hard.

Redding Gravelly Loam: On a nearly level, high terrace with distinct mound microrelief; under grass-forb range pasture; elevation 325 feet (3 miles northwest of Milton at center of sec. 6, T. 2 N., R. 10 E.):

A11—0 to 3 inches, light-brown (7.5YR 6/4) fine gravelly loam, reddish brown (5YR 4/4) when moist; weak, fine, platy structure, essentially massive when dry; slightly hard when dry, friable when moist; numerous fine roots; few fine pores; medium acid (pH 6.0); clear, smooth lower boundary.

A12—3 to 12 inches, strong-brown (7.5YR 5/6) gravelly loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure, essentially massive when dry; slightly hard when dry, friable when moist; numerous fine roots and fine pores; medium acid (pH 5.7); abrupt, smooth lower boundary.

B2—12 to 18 inches, reddish-brown (2.5YR 4/5) gravelly clay, dark red (2.5YR 3/6) when moist; weak, medium, prismatic structure; very hard when dry, firm when moist, very plastic and very sticky when wet; thick continuous clay films; few roots and few fine pores; strongly acid (pH 5.1); abrupt, wavy lower boundary.

Cm—18 to 28 inches, reddish-brown (5YR 5/4), indurated iron-silica hardpan with gravel; fine seams of light-colored silica and spots of dark manganese coatings; decreases in cementation with depth; clear, wavy lower boundary.

C—28 inches +, reddish-brown (5YR 5/4) very gravelly sandy loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard when dry, friable when moist; neutral (pH 7.1).

Rocklin Fine Sandy Loam: On a 3 percent slope that faces west; used for dry-farmed barley and fallow rotation; elevation 200 feet; (2 miles south of Montpelier, south side of center of sec. 6, T. 5 S., R. 12 E., 100 feet north of Monte Vista Road.):

A1p—0 to 9 inches, brown (7.5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; very weak, fine, granular structure, essentially massive when dry; hard when dry, firm when moist; many roots and fine pores; strongly acid (pH 5.2); clear, smooth lower boundary.

B1—9 to 17 inches, light reddish-brown (5YR 6/3) fine sandy loam, slightly finer textured than the A1p horizon, dark reddish brown (5YR 3/4) when moist; weak subangular blocky structure to massive; slightly hard when dry, friable when moist; some fine roots and many fine pores; strongly acid to medium acid (pH 5.2 to 5.9); few thin patchy clay films; clear, smooth lower boundary.

B21—17 to 22 inches, reddish-brown (5YR 5/3) heavy fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, subangular blocky structure, nearly massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; thin discontinuous clay films; slightly acid (pH 6.4); few roots; many fine pores; clear, smooth lower boundary.

B22—22 to 28 inches, reddish-brown (5YR 5/4) light sandy clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, medium and fine, blocky structure; hard when dry, friable when moist; plastic and slightly sticky when wet; few roots; numerous fine pores; neutral (pH 6.8); thin continuous clay films; abrupt, slightly wavy lower boundary.

Cm—28 to 34 inches, brown (10YR 5/3), strongly cemented iron-silica hardpan; cementation occurs particularly in the upper part, in the lower part it appears only in seams and surfaces of plates and beds; material can be cut easily with a pick or bar; gradual, smooth lower boundary.

C—34 inches +, pale-brown (10YR 6/3) and yellowish-brown (10YR 5/4) to white (10YR 8/1), bedded granitic sediments; weakly consolidated; can be cut with hand auger when moist; high in quartz, mica, and slightly weathered feldspar.

Rossi Clay in a nearly level grass-sedge range pasture; elevation 40 feet (east quarter corner of sec. 16, T. 3 S., R. 7 E., ½ mile north of Shoemake Avenue and 6 miles west-southwest of Salida):

A11—0 to 3 inches, gray (2.5Y 5/1) silty clay loam, very dark gray (2.5Y 3/1) when moist; recent deposition; weak, medium, subangular blocky structure; hard when dry, friable when moist; slightly plastic when wet; mildly alkaline (pH 7.7); abrupt, irregular lower boundary.

A12—3 to 11 inches, dark-gray (2.5Y 4/1) clay, black (2.5Y 2/1) when moist; strong, medium, and fine blocky structure; cracks and forms large blocks when thoroughly dry; very hard when dry, very firm when moist, very plastic and very sticky when wet; many saltgrass stolens; few fine pores; strongly alkaline (pH 9.0) with disseminated carbonates; clear, smooth lower boundary.

B21—11 to 21 inches, gray (2.5Y 5/1) heavy clay, very dark gray (2.5Y 3/1) when moist; strong, medium, subangular blocky structure; very hard when dry, very firm when moist; thin patchy clay films; some saltgrass stolens; very strongly alkaline (pH 9.4); disseminated carbonates; gradual, smooth lower boundary.

B22—21 to 38 inches, similar to B21 horizon but not quite so sticky; continuous moderately thick clay films; few, small, calcareous nodules; abrupt, wavy lower boundary.

Cg—38 to 56 inches, light-gray (5Y 7/1) clay loam, olive gray (5Y 5/2) when moist; many, fine, blue, yellow, brown, and strong-brown mottles that are larger and more prominent with depth; moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, very plastic and sticky when wet; large nodules of hard lime in the lower part; somewhat stratified with slightly coarser textured material; very strongly alkaline (pH 9.2).

Ryer Clay Loam: On a nearly level grass-forb range that was formerly in dry-farmed grain; elevation is 250 feet (1¼ miles east of Warnerville, ⅛ mile south of the Sierra Railroad, east side of sec. 30, T. 2 S., R. 13 E.):

A1—0 to 8 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; slightly platy in the upper inch; hard when dry, friable when moist, slightly plastic when wet; numerous fine roots and some very fine pores; slightly acid (pH 6.1); clear, smooth lower boundary.

B1—8 to 16 inches, reddish-brown (5YR 5/4) silty clay loam; reddish brown (5YR 4/4) when moist; weak, medium, blocky structure; hard when dry, firm when moist, slightly plastic when wet; few thin patchy clay films;

numerous fine roots and fine pores; slightly acid (pH 6.3); gradual, smooth lower boundary.

B21—16 to 25 inches, heavy silty clay loam similar to B1 horizon in color; moderate, medium, blocky structure; hard when dry, firm when moist, plastic and slightly sticky when wet; thin nearly continuous clay films; slightly acid (pH 6.1); gradual, smooth lower boundary.

B22—25 to 37 inches, heavy silty clay loam, similar to B1 horizon in color; moderate, medium, prismatic structure; hard when dry, firm when moist, plastic and sticky when wet; more fine pores and lower density than B21 horizon; thin continuous clay films; slightly acid (pH 6.5); gradual, smooth lower boundary.

B31—37 to 48 inches, similar to B22 horizon but is silty clay loam; weak, fine, blocky structure; hard when dry, firm to friable when moist, plastic when wet; many medium and fine pores; clear, smooth lower boundary.

B32—48 inches +, light-brown (7.5YR 6/4) heavy silt loam, brown (7.5YR 5/4) when moist; moderate, fine, blocky structure; a few coatings of redder soil on peds in upper part; hard when dry, friable to firm when moist; neutral (pH 6.6); many fine and medium pores.

Snelling Sandy Loam: On a 2 percent slope facing north; elevation 325 feet; under grass-oak range pasture (uncleared field in the NE¼ sec. 28, T. 3 S., R. 13 E., about 100 yards northeast of the southwest corner, 5 miles west of La Grange on State Highway No. 132):

A11—0 to 15 inches, brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure, essentially massive when dry; hard when dry, friable when moist; numerous fine roots; few wormholes; slightly acid (pH 6.3); clear, wavy lower boundary.

A12—15 to 19 inches, pale-brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) when moist; similar to A11 horizon; clear, smooth lower boundary.

B1—19 to 27 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 4/2) when moist; massive to very weak, medium, blocky structure; hard when dry, friable to firm; moderate fine and coarse roots; medium acid (pH 5.6); gradual, smooth lower boundary.

B21—27 to 40 inches, brown (10YR 5/3) light sandy clay loam, dark brown (7.5YR 4/3) when moist; common, coarse, faint mottles of dark brown (10YR 4/3, moist); weak, fine and medium, blocky structure, nearly massive when dry; hard when dry, firm when moist, sticky and plastic when wet; thin continuous clay films; moderate number of medium roots; strongly acid (pH 5.4); gradual, smooth lower boundary.

B22—40 to 56 inches, brown (7.5YR 5/4) heavy sandy loam, dark brown (7.5YR 4/4) when moist; similar to B21 horizon except for color; slightly acid (pH 6.1); clear, smooth lower boundary.

C—56 to 74 inches, brown (7.5YR 5/4) coarse sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and nonplastic when wet; few coarse mottles of yellowish red (5YR 3/5, moist); many fine pores; few roots; slightly acid (pH 6.2).

San Joaquin Sandy Loam: In a roadcut on gently undulating relief (2 percent slopes); elevation is 175 feet (NW¼NW¼ sec. 28, T. 2 S., R. 10 E., ½ mile north of Patterson Road on west side of Crane Road, 2 miles southwest of Oakdale):

A1p—0 to 3 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 4/2) when moist; weak, fine, platy to fine granular structure; soft when dry, friable when moist; many roots and medium and fine pores; medium acid (pH 6.0); abrupt, smooth lower boundary.

A12—3 to 10 inches, brown (7.5YR 5/3) sandy loam, reddish brown (5YR 4/3) when moist; weak, medium, platy structure to nearly massive; slightly hard when dry, friable when moist; some roots and many fine pores; medium acid (pH 5.6); abrupt, smooth lower boundary.

B1—10 to 13 inches, yellowish-red (5YR 5/6) heavy sandy loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, subangular blocky structure, nearly massive; slightly hard when dry, friable when moist, slightly plastic and sticky when wet; few roots; moderate number of fine pores; thin patchy clay films; medium acid (pH 5.8); clear, smooth lower boundary.

B21—13 to 19 inches, reddish-brown (5YR 5/4) light sandy clay loam, dark reddish brown (5YR 3/4) when moist; massive to weak, coarse, subangular blocky structure; hard when dry, firm when moist, plastic and slightly sticky when wet; few roots mainly in cracks; moderate medium and fine pores; thin continuous clay films; medium acid (pH 6.0); gradual, smooth lower boundary.

B22—19 to 24 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; strong, medium and coarse, prismatic structure; very hard when dry, firm when moist, very plastic and very sticky when wet; few roots in cracks and matted roots where they contact hardpan; a few fine and medium pores; thick continuous clay films, darker brown in the lower 2 inches; slightly acid (pH 6.2); very abrupt, smooth lower boundary.

Cm—24 to 48 inches, reddish-brown, indurated iron-silica hardpan with spots of purplish-black manganese oxides; gradually becomes softer with depth; few thin seams of lime below 29 inches; gradual, smooth lower boundary.

C—48 to 60 inches, light yellowish-brown (10YR 6/4) light sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, coarse, platy structure; weakly consolidated; hard when dry, firm when moist; mildly alkaline (pH 7.4); contains angular grains of quartz and feldspar and considerable mica.

Temple Silty Clay: On a nearly level flood plain under grass-forb range pasture; elevation about 50 feet (⅜ mile west of Jennings Road; 5 miles northeast of Patterson):

A11—0 to 8½ inches, gray (10YR 5/1) silty clay, dark gray (10YR 4/1) when moist; common, medium, distinct mottles and stains of dark yellowish brown (10YR 3/4); weak, very coarse, blocky structure (weak, thin, platy structure in the upper half inch); very hard when dry, friable when moist, slightly sticky and plastic when wet; many fine pores and fine roots; high in organic matter; neutral (pH 7.3); abrupt, smooth lower boundary.

A12—8½ to 15 inches, dark-gray (10YR 4/1) clay, black (10YR 2/1) when moist; moderate, medium and coarse, subangular blocky structure; hard when dry, firm when moist, plastic and slightly sticky when wet; common fine pores and roots; moderately alkaline (pH 7.9); clear, smooth lower boundary.

B2—15 to 21 inches, gray (2.5Y 5/1) clay, very dark gray (2.5Y 3/1) when moist; weak, medium, prismatic to moderate, coarse, blocky structure; hard when dry, firm when moist, plastic and slightly sticky when wet; common fine pores and roots; moderate continuous clay films on all ped faces; moderately alkaline (pH 7.9); clear, smooth lower boundary.

B22—21 to 26 inches, gray (5Y 5/1) silty clay with a few lime concretions, 2 to 4 millimeters in diameter; otherwise similar to B2 horizon; clear, smooth boundary.

B3—26 to 31 inches, clay loam that is between gray and grayish brown (2.5Y 5/1 and 5/2) and is very dark grayish brown (2.5Y 3/2) when moist; very weak, medium and coarse, prismatic structure; hard when dry, friable when moist, plastic and slightly sticky when wet; somewhat micaceous; thin patchy clay films only on vertical faces; common lime concretions, 2 to 4 millimeters in diameter; moderately alkaline (pH 8.0); clear, smooth lower boundary.

C—31 to 44 inches, loam that is between grayish brown and light brownish gray (2.5Y 5/2 and 6/2), dark grayish

brown (2.5Y 4/2) when moist; common, medium, distinct mottles of olive brown (2.5Y 4/4, moist); very weak, medium and coarse, prismatic structure; moderately alkaline (pH 7.9); slightly calcareous; may be underlain by stratified sand and very fine sandy loam.

TOOMES ROCKY LOAM: On a 1 percent slope facing south; elevation 360 feet; under grass-forb vegetation (north side of State Highway No. 120, 600 feet west of east side of sec. 28, T. 1 S., R. 12 E.):

A11—0 to 1 inch, brown (7.5YR 5/4) loam (near silt loam), dark brown (7.5YR 4/4) when moist; weak, fine, granular to thin platy structure; slightly hard when dry, friable when moist, slightly plastic when wet; numerous fine roots and pores; slightly acid (pH 6.1); clear, smooth lower boundary.

A12—1 inch to 11 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; similar to A11 horizon but medium acid (pH 5.9); abrupt, irregular lower boundary.

Dr—11 inches +, dense, hard, latite lava with occasional narrow, deep cracks filled with soil from A12 horizon.

TRAVER SANDY LOAM: In a nearly level grass-salt shrub pasture; elevation 50 feet (1/8 mile southeast of the north quarter corner of sec. 21, T. 3 S., R. 7 E., 7 miles west-southwest of Salida, 1/8 mile south of Shoemake Avenue):

A11—0 to 3 inches, grayish-brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine and very fine, blocky to fine granular structure; slightly hard when dry, friable when moist; many fine pores and saltgrass stolens; moderately alkaline (pH 8.1); abrupt, smooth lower boundary. (This layer may be a fairly recent deposit.)

A12—3 to 7 inches, light brownish-gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) when moist; faintly mottled with slightly browner color; massive; slightly vesicular; slightly hard when dry, friable when moist; strongly calcareous; moderately alkaline (pH 8.1); gradual, smooth lower boundary.

A13—7 to 23 inches, light yellowish-brown (2.5Y 6/3) sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; slightly hard when dry, friable when moist; fine pores are common; moderate roots; strongly calcareous; very strongly alkaline (pH 9.3); abrupt, smooth lower boundary.

B2—23 to 31 inches, light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; few, faint mottles of slightly stronger brown; massive; hard when dry, very firm when moist, slightly plastic when wet; few fine pores; few roots; few thin patchy clay films in pores and on sand grains; strongly calcareous; very strongly alkaline (pH 9.7); clear, smooth lower boundary.

C—31 inches +, light yellowish-brown (2.5Y 6/3) light sandy loam, olive brown (2.5Y 4/4) when moist; massive; soft when dry, friable when moist; few, fine, faint mottles of strong brown; somewhat stratified with finer and coarser layers; moderately calcareous; very strongly alkaline (pH 10.2).

TUJUNGA SAND: On a nearly level flood plain; elevation 60 feet; in range pasture with grass-forb and willow vegetation (NE¼ sec. 20, T. 2 S., R. 9 E., 8 miles north of Modesto; 50 feet east of the Tidewater Southern Railroad, 100 yards south of the Stanislaus River):

C—0 to 60 inches, light brownish-gray (10YR 6/2) sand stratified with loamy sand and fine sand, grayish brown (10YR 5/2) when moist; single grain; loose, incoherent; thick bermudagrass roots and stolens in upper part; few roots below 20 inches; neutral (pH 6.9 to 7.3) with depth; may be underlain by finer textured soil similar to that of the Hanford or Grangeville soils.

WAUKENA FINE SANDY LOAM: In a nearly level, unirrigated area in an irrigated pasture; elevation 60 feet; under saltgrass vegetation (200 yards north of the south quarter corner of sec. 19, T. 5 S., R. 9 E., about 1½ miles southwest of Mountain View School, 9 miles south of Modesto):

A1p—0 to 4 inches, gray (10 YR 6/1) fine sandy loam, very dark gray (10YR 3/1) when moist; weak, medium and fine, platy structure to nearly massive in the lower part; slightly hard when dry, friable when moist; numerous fine pores and saltgrass stolens; few, fine, faint mottles of light yellowish brown (2.5Y 6/4) when dry; medium acid (pH 5.9); abrupt, smooth lower boundary.

A2g—4 to 6 inches, light-gray (10YR 7/1) fine sandy loam, grayish brown (10YR 5/2) when moist; medium distinct mottles of light yellowish brown (2.5Y 6/4) when dry; massive; slightly hard when dry, friable when moist; slightly acid (pH 6.5); abrupt, lower boundary, with thin layers that extend into the cracks in the horizon below.

B21g—6 to 14 inches, between grayish-brown (2.5Y 5/2) and light brownish-gray (2.5Y 6/2) heavy fine sandy loam, grayish brown (2.5Y 5/2) when moist; numerous, medium and fine, prominent mottles of strong brown (7.5YR 5/6) when dry; strong, coarse and very coarse, columnar structure with bleached rounded caps; hard when dry, very firm when moist, slightly plastic and sticky when wet; few, fine, iron concretions (shot); very few fine pores and fine roots but a few coarse roots in cracks; thin continuous clay films; moderately alkaline (pH 7.9); some segregated lime in small blotches; gradual, smooth lower boundary.

B22g—14 to 24 inches, light yellowish-brown (2.5Y 6/3) heavy sandy loam, olive brown (2.5Y 4/4) when moist; medium and fine distinct mottles of strong brown; moderate, medium, blocky structure; very hard when dry, firm when moist, plastic and sticky when wet; white blotches of segregated lime; strongly alkaline (pH 8.5); clear, smooth lower boundary.

Cg—24 inches +, light-gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) when moist; many, fine and medium, distinct mottles of yellowish brown (10YR 5/6) when moist; massive; very hard when dry, friable when moist, slightly plastic and slightly sticky when wet; strongly alkaline (pH 8.7); lime concretions, ¼ to 1 inch in diameter.

WHITNEY FINE SANDY LOAM: On a 12 percent slope facing south in a field used for barley-fallow rotation; elevation 250 feet (SE¼ sec. 4, T. 4 S., R. 12 E., 6 miles east of Hickman, ¼ mile south of La Grange Road, just west of Hawkins Road):

Ap—0 to 7 inches, brown (near grayish-brown) (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, granular structure, nearly massive when dry; slightly hard when dry, friable when moist; many fine roots and fine pores; slightly acid (pH 6.1); gradual, smooth lower boundary.

B2—7 to 16 inches, similar to Ap horizon; weak subangular blocky structure; slightly hard when dry, friable when moist, slightly plastic and nonsticky when wet; many fine roots and fine pores; thin patchy clay films that are very slightly redder than the interiors of peds; slightly acid (pH 6.1); diffuse lower boundary.

C1—16 to 31 inches, brown (10YR 5/3) fine sandy loam that contains fragments of weathered parent material as much as 3 inches in diameter; dark brown (10YR 4/3) when moist, blotches of pale brown (10YR 6/3) when dry; massive; slightly hard when dry, friable when moist; few roots; many fine and medium pores; few thin patchy clay films in pores; slightly acid (pH 6.3); clear, broken lower boundary.

C2—31 inches +, pale-yellow (2.5Y 8/4) granitic sediments, light brownish gray (2.5Y 6/2) when moist; thin platy structure to massive; horizontally bedded—a high

content of mica between plates; weakly consolidated to soft in places; brown stain in root channels; in many places can be cut with a hand auger with little difficulty; neutral (pH 7.3).

WHITEROCK ROCKY SILT LOAM: On a slope of 5 percent facing east in a grass-forb range; elevation 400 feet (2 miles east of La Grange, south of the center of sec. 21, T. 3 S., R. 14 E.):

A1—0 to 8 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak granular structure that dries to massive; slightly hard; friable; numerous fine roots and pores; slightly acid (pH 6.2); abrupt, slightly irregular lower boundary.

Dr—8 inches +, light olive-gray (5Y 6/2) hard slate with near vertical cleavage; frequent outcrops give rise to tombstonelike, vertical slabs, 1 to 3 feet in height.

WYMAN LOAM: On a 2 percent slope facing north in a grass-forb range pasture that was formerly dry farmed; elevation 160 feet (SE¼ sec. 14, T. 3 S., R. 11 E., 3 miles northeast of Waterford on the north side of Tim Bell Road):

A1p—0 to 6 inches, brown (10YR 5/3) loam; dark brown (10YR 3/3) when moist; weak, fine, granular structure that dries massive; slightly hard when dry, friable when moist; many fine roots and medium and fine pores; neutral (pH 6.7); clear, smooth lower boundary.

B1—6 to 11 inches, grayish-brown (10YR 5/2) sandy clay loam; very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; many fine roots and fine pores; few thin patchy clay films in pores; slightly acid (pH 6.2); clear, smooth lower boundary.

B21—11 to 25 inches, dark-brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) when moist; moderate, medium, blocky structure; hard when dry, friable when moist, plastic and slightly sticky when wet; thin nearly continuous clay films on peds and in pores; medium roots and fine pores; slightly acid (pH 6.2); gradual, smooth lower boundary.

B22—25 to 40 inches, brown (10YR 5/3) light sandy clay loam, dark brown (10YR 4/3) when moist; weak, very fine, blocky structure; hard, friable, slightly plastic and slightly sticky; thin nearly continuous clay films; medium roots and fine pores; slightly acid (pH 6.4); gradual, smooth lower boundary.

C—40 to 60 inches, brown (7.5YR 5/3) heavy fine sandy loam, dark brown (7.5YR 4/3) when moist; massive; slightly hard when dry, friable when moist; few roots and few fine pores; neutral (pH 6.6); this horizon is several feet thick and is underlain by stratified sandy or gravelly coarse material.

YOKOHL SILTY CLAY LOAM: In a nearly level, unused area under grass-forb vegetation; elevation 250 feet (sec. 25, T. 2 S., R. 12 E., ¼ mile south of Warnerville on the east side of the road):

A1—0 to 10 inches, brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) when moist; weak, medium and fine, blocky structure; hard when dry, friable when moist; slightly acid (pH 6.1); low content of organic matter; clear, smooth lower boundary.

B1—10 to 16 inches, brown (7.5YR 5/5) silty clay loam, reddish brown (5YR 4/4) when moist; weak, medium, prismatic structure; hard when dry, friable when moist, slightly plastic and slightly sticky when wet; medium fine roots and many fine pores; surfaces of peds are slightly paler than the interiors; thin patchy clay films; slightly acid (pH 6.2); gradual, smooth lower boundary.

B21—16 to 26 inches, reddish-brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; hard when dry, firm when moist, very plastic and sticky when wet; few fine roots and fine pores; slightly acid (pH 6.1); thin continuous clay films of similar color; clear, smooth lower boundary.

B22—26 to 30 inches, brown (7.5YR 5/5) heavy silty clay loam, dark brown (7.5YR 4/4) when moist; few faint mottles of yellowish red (5YR 5/5) and a few, fine, dark manganese spots; moderate, medium, prismatic structure; very hard when dry, firm when moist, very plastic and sticky when wet; thin continuous clay films; neutral (pH 6.6); abrupt, smooth to slightly wavy lower boundary.

Cm—30 to 37 inches, pale-brown (10YR 6/3) iron-silica hardpan with coatings and seams of strong brown (7.5YR 5/6); fine platy structure; strongly cemented, but can be broken easily with a pick; common medium blotches and fine specks of black manganese oxides; gradual, smooth lower boundary.

C—37 inches +, very pale brown (10YR 7/3) silt loam, brown (7.5YR 5/3) when moist; weak, medium, platy structure; hard when dry, friable when moist, slightly plastic when wet; mildly alkaline (pH 7.7).

ZACA CLAY: In a fresh road cut, on a slope of 16 percent facing south; elevation 360 feet (east side of sec. 13, T. 2 S., R. 11 E., in a road cut along Hetch Hetchy aqueduct):

A11—0 to 6 inches, dark-gray (5YR 4/1) clay, dark reddish brown (5YR 3/2) when moist; strong, medium and coarse, blocky structure that breaks to strong, fine, granular when dry; hard when dry, friable when moist, very plastic and sticky when wet; many roots and medium pores; moderately calcareous, with some nodules; mildly alkaline (pH 7.4); clear, smooth lower boundary.

A12—6 to 10 inches, dark-gray (5YR 4/1) clay, dark reddish brown (5YR 3/2) when moist, with large calcareous blotches of pinkish gray (5YR 6/2, dry; reddish gray, 5/2 moist); strong, medium, blocky structure; hard when dry, friable when moist, very plastic and sticky when wet; some hard lime nodules; mildly alkaline (pH 7.5); abrupt, somewhat broken lower boundary.

Cca—10 to 30 inches, light-gray (7.5YR 7/1), very strongly calcareous, marly sediments somewhat stratified and platy, brown (7.5YR 5/2) when moist; hard when dry, firm when moist; lime is present in large, soft blotches and in hard seams and decreases gradually with depth; mildly alkaline (pH 7.4); diffuse lower boundary.

C—30 inches +, light-gray (10YR 7/1) calcareous shale or mudstone, brown (7.5YR 5/2) when moist; weakly consolidated lime present only in seams.

General Nature of the Area

This section contains general information about Stanislaus County and the Area covered by this survey. Among the features described are climate, vegetation, wildlife, land use, livestock, water for irrigation, history and population, industries, transportation, and marketing facilities.

Climate [8]

The Eastern Stanislaus Area has warm, dry summers and cool, moist winters. The average annual rainfall ranges from 10 inches at the western edge of the Area to 18 inches at the eastern boundary (fig. 25).

[8] Data furnished by the office of C. ROBERT ELFORD, State climatologist, U.S. Weather Bureau, San Francisco, Calif.

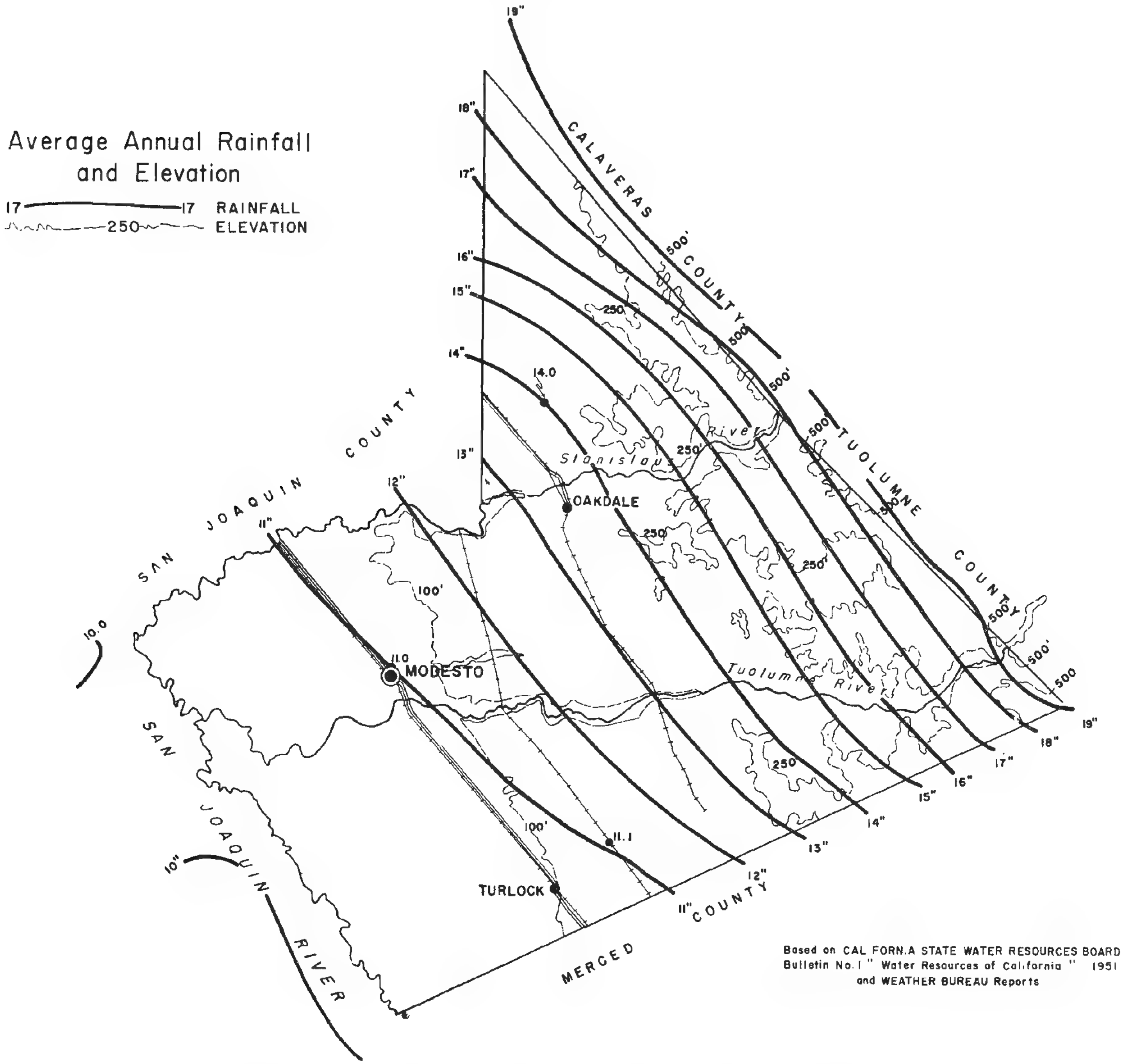

***Figure 25.*—Average number of inches of annual rainfall at various elevations.**

The amount of rainfall varies considerably from year to year; for example, at Modesto the average annual rainfall was 11.15 inches for the 75 years prior to 1960, but in two different years there were less than 4 inches of rainfall. The probability of the occurrence of stated amounts of annual rainfall at Modesto is as follows:

Seasonal rainfall of at least:	*Probable occurrence*
5.61 inches	19 years in 20
6.64 inches	9 years in 10
8.39 inches	3 years in 4
9.09 inches	2 years in 3

Seasonal rainfall of at least:	*Probable occurrence*
10.77 inches	1 year in 2
12.32 inches	1 year in 3
13.35 inches	1 year in 4
16.13 inches	1 year in 10
17.93 inches	1 year in 20

In summer, temperatures are high; they average near 90° F. in the afternoon, and during short, dry spells, they rise above 100°. Night temperatures are generally cool—about 50° to 55°. In winter, temperatures usually range from about 55° during the day to 35° at night; there are

periods of fog and an occasional frosty morning. Monthly minimum, maximum, and average temperatures at Modesto are shown in figure 26.

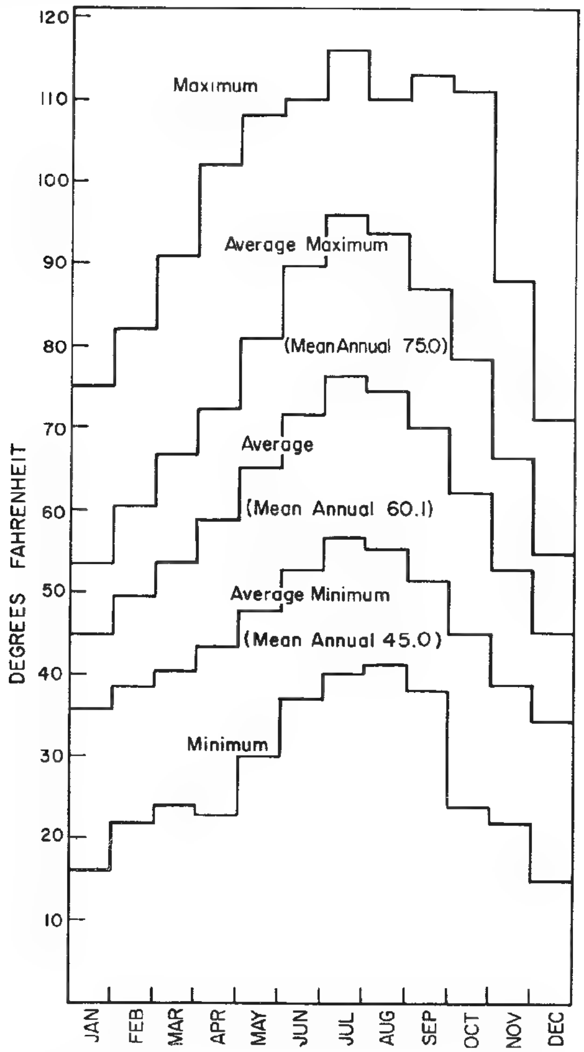

Figure 26.—**Monthly maximum, minimum, and average temperatures at Modesto.**

Unless orchards and vineyards are protected by heaters or other means, frosts late in spring occasionally endanger the blossoms and the young fruit. Based on a 29-year record (*1*), heating of orchards has been necessary on an average of 6 nights per year. Nevertheless, there has been an average of 17 nights per year with temperatures of 32°. On the average, the last frost occurs late in March, except in the lowest parts of river bottoms, where it occurs as late as mid-April. The average dates of the last 32° temperature in spring are given for weather stations in Stanislaus County in table 18. In autumn the first frosts generally occur in mid-November but rarely damage crops seriously.

Because of the warm temperatures and the small amount of rainfall in summer, evapotranspiration (the use of water by plants in addition to evaporation from the soil) greatly exceeds the precipitation, as indicated in (fig. 27). At Modesto rainfall exceeds evapotranspiration only during December, January, February, and March. This excess amounts to 4.3 inches, but it is depleted by about May 20. Ample irrigation water is available to much of the Area, however. Because of the irrigation water, the long, sunny growing season, and the mild winters, a great variety of crops can be produced.

TABLE 18.—*Average dates of the last 32° temperature in spring at weather stations in Stanislaus County* (*1*)

Location of stations	Date of last 32° temperature	Length of record
		Years
1 mile northeast of Modesto at KTRB	Mar. 19	24
3 miles east of Oakdale	Mar. 20	12
1 mile northwest of Waterford	Mar. 24	24
1½ miles east of Ceres	Mar. 29	24
Hughson (Halford Ranch)	Mar. 24	12
3 miles northeast of Patterson	Mar. 16	24
Tuolumne River bottom near Shiloh School; 9 miles west of Modesto.	Apr. 5	24
Roberts Ferry (bottom land)	Mar. 21	12
2 miles northeast of Denair	Mar. 19	11
2 miles west of Oakdale (bottom land)	Apr. 1	17
3 miles southeast of Patterson	Apr. 6	14

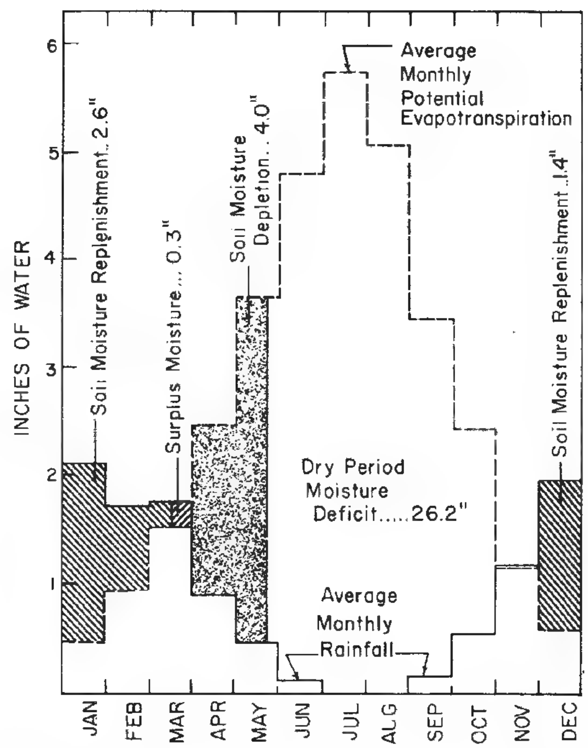

Figure 27.—**Average monthly rainfall and potential evapotranspiration at Modesto, calculated according to Thornthwaite (*15*); based on a soil with 4 inches of available water-holding capacity.**

Vegetation

The native vegetation of the Eastern Stanislaus Area has been replaced largely by introduced species or has

been destroyed by cultivation and grazing.[9] Native trees, however, grow in the foothills and along the streams. Blue oak (*Quercus douglasii*) is the dominant tree of the foothills. On the river bottoms are California white oak (*Quercus lobata*), cottonwood (*Populus fremontii*), and willows (*Salix* sp.).

Annual grasses and forbs predominate on the open rangelands of the eastern part of the Area. Important annual grasses are wild oats (*Avena* sp.), soft chess (*Bromus mollis*), ripgut (*Bromus rigidus*), red brome (*Bromus rubens*), fescues (*Festuca* spp.), and wild barley (*Hordeum* sp.); perennial grasses are bluegrass (*Poa scabrella*) and needlegrass (*Stipa speciosa*). On droughty or infertile soils, a small leafy forb called filaree (*Erodium cicutarium*) is predominant, but lupine (*Lupinus* sp.) and California-poppy (*Eschscholtzia californica*) are mixed with grasses, mainly ripgut. On clay soils, burclover (*Medicago hispida*) and cutleaf geranium (*Geranium dissectum*) are common; they are mixed with wild oats. The more fertile, medium-textured soils produce all of the grasses and forbs just mentioned and many others as well.

In the uncultivated pastures in the western part of the Area, the plants already mentioned are present, in addition to some other important ones. Very sandy soils support distinctive vegetation dominated by weeds, such as turkey-mullein (*Eremocarpus setigerus*); a tall woolly plant (*Heterotheca grandiflora*); Russian-thistle, or tumbleweed (*Salsola kali*); and bluecurls, or camphorweed (*Trichostema lanceolatum*). A group of plants that generally occur on saline or saline-alkali soils includes saltgrass (*Distichlis* sp.), saltbushes (*Atriplex* spp.), alkali heath (*Frankenia grandiflova*), and alkali mallow (*Sida hederacea*). Also, spikeweed (*Centromadia pungens*) and alkali blight (*Suaeda fruticosa*) are particularly indicative of saline-alkali soils.

Plants commonly found in swampy and poorly drained areas are cattail (*Typha* sp.), bulrush or tule (*Scirpus acutus*), nutgrass (*Cyperus esculentus*), baltic rush (*Juncus balticus*), and dock (*Rumex* sp.). Bottom lands subject to occasional flooding support a lush growth of a wide variety of grasses, weedy forbs, willows, and oaks. Especially noticeable are beardless wildrye (*Elymus triticoides*), gumweed (*Grindelia camporum*), and lippia (*Lippia nodiflora*).

Weeds are a serious problem in many places. The most troublesome weeds in intensively irrigated areas are bermudagrass, johnsongrass, puncturevine, sandbur, cocklebur, and morning-glory. Watergrass, dogfennel, dallisgrass, and knotgrass infest many irrigated pastures. In the dry-farmed fields of grain, wild radish and particularly morning-glory are serious pests. Rattleweed, or locoweed (*Astragalus leucophyllus*); black nightshade (*Solanum* sp.); and wild tobacco (*Nicotiana* sp.) are poisonous to livestock, but they occur only in local spots.

Wildlife

Although abundant elk, deer, and antelope were reported in the San Joaquin Valley in the early 1800's, the wildlife of Eastern Stanislaus Area now consists mainly of rodents and birds. Deer are seen along the eastern foothills occasionally. Rodents are very numerous. Ground squirrels are considered pests in the rangelands, and poisoned grain is used to kill them. Pocket gophers and rabbits are common pests throughout the Area.

Ducks, geese, and other water-loving birds are plentiful along the San Joaquin River. They are hunted, in season, along the river and also around reservoirs and stock ponds in the eastern part of the Area. Quail, doves, and pheasants are common in the less populous areas. Flocks of blackbirds sometimes attack new seedings of grain or pasture seeds.

Land Use

According to United States Census of Agriculture for 1960, 88.3 percent of the land area of Stanislaus County is in farms. Most of the farms are owned by the operators, but a large number are rented. More than half of the land in farms is cropland, and almost all the rest is pasture. According to the Federal census, 355,423 acres, or nearly 42 percent, of the land in farms, were irrigated; 248,530 acres, or more than 88 percent of the cropland harvested, were irrigated. Many farms are between 10 and 29 acres in size, and about 69 percent are less than 50 acres. Though only about 2 percent of the farms are more than 1,000 acres in size, these large holdings make up more than half of the acreage in farms. Most of the acreage of these large farms is in dry-farmed grain and range pasture used for beef cattle production.

Stanislaus generally ranks as one of the leading counties of the United States in agricultural income. For a number of years, it has been among the largest producers of peaches, dairy products, turkeys, and walnuts. The income is divided about evenly between that derived from livestock products and that from crops. Dairying accounts for a considerable part of the total cash returns.

Many different commercial crops are grown in the county. The principal crops grown are alfalfa and other hay crops, corn, sorghum, annual legumes, small grains (principally barley), vegetables, fruit and nut trees, and grapes. A large acreage is in irrigated pasture. The principal livestock products are dairy products, beef cattle, turkeys, and chickens.

Livestock

About half of the agricultural income of Stanislaus County is derived from livestock. Dairying is an important industry. Beef cattle, chickens, and turkeys are raised in large numbers.

Dairy cattle.—The dairy industry in the county is based to a large extent on locally produced ladino clover pasture and alfalfa hay. Consequently, the dairy farms are located on the irrigated hardpan soils and imperfectly drained soils, which are well suited to irrigated pasture but not so well suited to more intensive crops. In 1959, according to the Federal census, 1,905 farms reported 69,062 milk cows. The same year, 1,551 farms reported 624,996,734 pounds of whole milk sold.

Beef cattle.—Beef cattle are produced in the eastern part of the Area. Beef cattle production depends on the combination of range pasture for winter forage and irrigated pasture in adjoining areas. Several beef cattle ranches

[9] HOOVER, ROBERT F. PRIMITIVE VEGETATION OF THE SAN JOAQUIN VALLEY. 1935. [Master's thesis submitted to the Univ. Calif.]

are in the basin area on the eastern edge of the San Joaquin River flood plain.

Chickens and turkeys.—The mild climate and well-drained, sandy soils of Stanislaus County provide almost ideal conditions for poultry production. The county is one of the largest producers in the nation. According to the Federal census, 121 farms reported 1,451,959 turkeys raised in 1955, 454 farms reported 3,790,804 chickens sold, and 455 farms reported 23,648,214 chicken eggs sold.

Water for Irrigation

Most of the irrigation water used in the Area comes from the Tuolumne and Stanislaus Rivers and through the canals of four irrigation districts (see figure 15). In 1956, approximately 1 million acre-feet of water were diverted from these rivers into canals for use in the Area. Also, about 280,000 acre-feet of water were pumped into the canals from drainage wells. Of this amount, each acre of irrigated land received about 3 acre-feet of water. In some dry years, the gravity water supply is somewhat limited. In the driest years, between 1946 and 1956, however, the water supply did not fall below 75 percent of the 1956 value, except in the Oakdale District. In this district it fell in 1948 to 67 percent of the 1956 value (*13*). Even in the driest years, irrigated crops have been affected only slightly by lack of water, except those grown in the Oakdale District. New dams on the Stanislaus River will increase the supply of water and should prevent water shortages in the Oakdale District.

Water diverted from the Tuolumne and Stanislaus Rivers is of excellent quality for irrigation; it has less than four parts per million of chlorides and is very low in total dissolved solids. Except in the extreme western part of the Area along the San Joaquin River and in a few wells elsewhere, water pumped from wells is of excellent quality.

History and Population

In 1826 a party of fur trappers operated in the San Joaquin Valley. Later, the Hudson Bay Company established a fur-trapping camp near what is now Stockton. The supply of otter and beaver was soon depleted, however, and fur trading died down.

From 1826 to 1845, a number of explorers visited the San Joaquin Valley, and in 1841 the first band of overland immigrants came across the Sierras, down the Stanislaus River, and then north to Sutter's Fort. In about 1845, immigrants began to arrive in steadily increasing numbers by ship and by covered wagon. The first settlers in the Eastern Stanislaus Area were Mexican citizens who were granted large tracts in 1843 and 1844 for cattle grazing.

During the gold-rush period, beginning in 1848, the population of California increased to at least 100,000. Most of the gold seekers who came by ship considered the valley only an obstacle to be crossed in reaching the mines. Some people, however, soon saw the valley as a place for raising livestock and crops that would bring high prices from the miners. They settled along the rivers, mostly at the busy ferry sites. For the next decade, the settlers mainly raised horses and other kinds of livestock.

Wheat was grown in small acreages as early as 1850. Between 1860 and 1870, many stockmen turned to the growing of grain because of the high prices of wheat, the disastrous losses of cattle in the floods of 1862, the total drought in 1863, and the loss of livestock through diseases. Except during occasional droughty years, the climate and virgin soil were favorable for grain crops, and soon huge acreages of wheat were being planted. In 1884 an estimated 7 million bushels of wheat were grown in Stanislaus County. Between 1886 and 1900, however, yields of wheat and the price of wheat began to decline, and farmers started to look for more profitable crops that were not subject to periodic droughts. It became evident to the more progressive farmers that some form of irrigation had to be developed.

Eventually, a water-storage dam was constructed at La Grange on the Tuolumne River and a network of canals was laid out through the valley. By 1904, the Turlock and Modesto Irrigation Districts were operating. Smaller irrigation districts were formed near Waterford and Oakdale. The Oakdale District derives its supply of water from the Stanislaus River. When a dependable supply of water was established, the kinds of crops grown and their yields increased greatly. In 1950 almost 100 years after the first settlement in the Area, 80 different commercial crops were produced.

The agricultural expansion that resulted from the development of a supply of irrigation water is reflected in the rate of population increase. Between 1860 and 1890, the population of the Eastern Stanislaus Area gradually increased from 2,000 to 8,482, and then in 1900 it declined slightly to 7,790. In the 20 years following the building of the irrigation canals, however, the population more than quadrupled, and it reached 36,885 in 1920. Since then, the population has again quadrupled; it was 146,540 in 1960.

In 1960 Modesto, the county seat and the largest city in the Area, had a population of nearly 50,000 in the city and surrounding suburbs. The population within the city limits was 36,585. Turlock, the second largest community, had a population of 9,116 in 1960. In the same year Oakdale and Ceres each had a population of more than 4,000, and six other communities each had a population of more than 1,000.

Industries, Transportation, and Marketing Facilities

The processing of wine, canned fruits and vegetables, milk products, and frozen foods, including meat and poultry, are the main industries in the Area. Several large plants produce packaging materials, such as cans and cartons. Also produced in the Area are lumber, wood products and furniture, chemicals, fabricated metals, machinery, transportation equipment, and stone, clay, and glass products.

Modesto and Turlock, the main industrial centers, are important for the processing and shipping of agricultural products.

Main lines of both the Santa Fe and Southern Pacific Railroads cross the Area from north to south. The Tidewater Southern Railway enters Modesto from the south and connects with the Western Pacific at Stockton. A branch line of the Southern Pacific serves Oakdale, Waterford, and Hickman and connects at Oakdale with the Sierra Railroad, which serves points in Tuolumne County

to the east. The Modesto and Empire Traction Company runs local freight between Modesto and Empire and connects with the main line of the Southern Pacific at Modesto and the Santa Fe Railroad at Empire.

There are 2,500 miles of roads in the county. Most of the roads are hard surfaced; 97 percent of the farms adjoin hard-surfaced roads. United States Highway No. 99, a main north-south artery, passes through Modesto and Turlock, and State Highway Nos. 120 and 132 cross the Area from east to west.

The Area is served by four buslines, and scheduled airline service is available at Modesto. There are several airports in the Area, and increasing quantities of perishable products are being shipped as airfreight.

Marketing facilities in the Area are well developed. Almost all agricultural products are processed for sale within the Area or for shipment. In 1951, there were 112 buyers or processors of agricultural products in Modesto alone.

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Glossary

ABC soil. A soil that has a complete profile, including an A, B, and C horizon.

AC soil. A soil that has an A and C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

Aggregate. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Base saturation (soil chemistry). The degree to which a material is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bench terrace. A shelflike embankment of earth that has a level or nearly level top and a steep or vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face of the bench may be made of rocks or masonry, or it may be planted to vegetation.

Broad-base terrace. A ridge-type terrace, 10 to 20 inches high and 15 to 30 feet wide, with gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. This kind of terrace is constructed to control erosion by diverting runoff along the contour at a nonscouring velocity. It may be level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrocloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Hard grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds that cement the soil grains together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose. Noncoherent; will not hold together in a mass.

Friable. When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky. When wet, adheres to other material; tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard. When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, breaks into powder or individual grains under very slight pressure.

Diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course, and, thus, to protect areas downslope from the effects of such runoff. The ridge is higher and the channel has more capacity than that of a field terrace.

Eolian (aeolian) soil material. Soil parent material accumulated through wind action; commonly refers to sandy material in dunes.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which the soil originated, with special reference to the processes responsible for the development of the solum, or true soil, from the unconsolidated parent material.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, usually in the subsoil or substratum, as a result of poor aeration and drainage; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Gley soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. The relative position of the several soil horizons in a typical soil profile and their nomenclature are as follows:

A0 Organic debris, partly decomposed or matted.

A1 A dark-colored horizon having a fairly high content of organic matter mixed with mineral matter.

A2 A light-colored horizon, often representing the zone of maximum leaching where podzolized; absent in wet, dark-colored soils.

A3 Transitional to B horizon but more like A than B; sometimes absent.

B1 Transitional to B horizon but more like B than A; sometimes absent.

B2 A usually darker colored horizon, which often represents the zone of maximum illuviation where podzolized.

B3 Transitional to C horizon.

C Slightly weathered parent material; absent in some soils.

D Any stratum underlying the C, or the B if no C is present, which is unlike C, or unlike the material from which the solum has been formed.

Dr Consolidated parent rock like that from which the C has developed or like that from which the parent material of the solum has developed if no C is present.

The A horizons make up a zone of eluviation, or leached zone. The B horizons make up a zone of illuviation, in which clay and other materials have accumulated. The A and B horizons, taken together, are called the solum, or true soil.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Irrigation. The artificial application of water to soils to assist in the production of crops. The common methods of irrigation are these:

Border. Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding. Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Furrow. Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler. Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Wild flooding. Irrigation water, which is released at high points, flows onto the field without controlled distribution.

Microrelief. Minor surface configurations of the land.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biological properties of the various horizons that make up the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common, and many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, value of 6, and a chroma of 4.

Narrow-base terrace. A terrace similar to a broad-base terrace except for the width of the ridge and channel. The base of a narrow-base terrace is ordinarily 4 to 8 feet wide.

Natural drainage. Refers to moisture conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time; podzolic soils commonly have mottlings below 6 to 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH. A numerical means for designating relatively weak acidity and alkalinity, as in soils and other biological systems. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Podzolization. The process by which a soil is depleted of bases, becomes more acid, and develops a leached surface layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction, because it is neither acid nor alkaline. In words the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6–7.3
Very strongly acid	4.5–5.0	Mildly alkaline	7.4–7.8
Strongly acid	5.1–5.5	Moderately alkaline	7.9–8.4
Medium acid	5.6–6.0	Strongly alkaline	8.5–9.0
Slightly acid	6.1–6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Silica. An important soil constituent composed of silicon and oxygen. The essential material in the mineral called quartz.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the base of a slip surface on a relatively steep slope; and in swelling clays, where there is marked change in moisture content.

Slick spots. Small areas in a field that are slick when wet because they contain excess exchangeable sodium, or alkali.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate, and living matter acting upon parent material, as conditioned by relief over periods of time.

Soil variant. A soil having properties sufficiently different from those other known soils to justify establishing a new soil series, but of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts runoff so that it may soak into the soil or flow slowly to a prepared outlet. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod. See also broad-base terrace, narrow-base terrace, bench terrace, and diversion terrace.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. (See also Clay, Sand, and Silt.) The basic textural classes, in order of increasing proportions of fine particles are as follows: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements found in soils in extremely small amounts, yet which are essential to plant growth. Some of the trace elements are zinc, cobalt, manganese, and copper. Synonym: Minor elements.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS AND CAPABILITY UNITS

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page
AcA	Alamo clay, 0 to 1 percent slopes	22	IIIw-5	90
AgB	Amador gravelly loam, 0 to 8 percent slopes	22	VIIe 9	97
AmB	Amador loam, 0 to 8 percent slopes	22	VIIe-9	97
AmD	Amador loam, 8 to 30 percent slopes	22	VIIe-9	97
AmF	Amador loam, 30 to 60 percent slopes	22	VIIe-9	97
AnA	Anderson gravelly fine sandy loam, 0 to 3 percent slopes	22	IIIs-4	91
AnB	Anderson gravelly fine sandy loam, 3 to 8 percent slopes	22	IIIs-4	91
AoA	Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes	22	IIIs 4	91
AuB	Auburn clay loam, 3 to 8 percent slopes	22	IVe-3	92
AuD	Auburn clay loam, 8 to 20 percent slopes	22	VIe-3	95
BcA	Bear Creek clay loam, 0 to 3 percent slopes	24	IIs-3	88
BeA	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes	24	IVe-3	92
BgA	Bear Creek gravelly loam, 0 to 3 percent slopes	24	IIs-3	88
BmA	Bear Creek loam, 0 to 3 percent slopes	24	IIs-3	88
CaA	Chualar sandy loam, 0 to 3 percent slopes	24	IIs-7	88
CbA	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes	24	IIs 6	88
CcA	Columbia fine sandy loam, 0 to 1 percent slopes	24	IIw-2	87
CdA	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes	24	IIIw-6	90
CeA	Columbia loam, 0 to 1 percent slopes	26	IIw 2	87
CfA	Columbia silt loam, 0 to 1 percent slopes	26	IIw-2	87
CgA	Columbia silt loam, slightly saline, 0 to 1 percent slopes	26	IIw-2	87
ChA	Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes	26	IIIw-3	90
CkA	Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes	26	IIw-2	87
CmA	Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes	26	IIw 2	87
CnA and TdA	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes	62	IIIw-6	90
CoA	Columbia silty clay loam, slightly saline, 0 to 1 percent slopes	26	IIw-2	87
CpA	Columbia soils, 0 to 1 percent slopes	26	IIw-2	87
CsB	Columbia soils, channeled, 0 to 8 percent slopes	28	IIIe-4	89
CyB	Corning gravelly sandy loam, 3 to 8 percent slopes	28	IVe-3	92
CyC	Corning gravelly sandy loam, 8 to 15 percent slopes	28	IVe-3	92
CyD	Corning gravelly sandy loam, 15 to 30 percent slopes	28	VIe-9	96
DeA	Delhi loamy sand, 0 to 3 percent slopes	28	IIIe-4	89
DeB	Delhi loamy sand, 3 to 8 percent slopes	28	IIIe-4	89
DfA	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes	28	IIIe-4	89
DgA	Delhi loamy sand, silty substratum, 0 to 3 percent slopes	28	IIIe-4	89
DhA	Delhi sand, 0 to 3 percent slopes	30	IVe 4	93
DhB	Delhi sand, 3 to 8 percent slopes	30	IVe-4	93
DkA	Dello loamy sand, 0 to 1 percent slopes	30	IVw-4	93
D.	Dredge and mine tailings	34	VIIIs-1	97
DmA	Dinuba fine sandy loam, 0 to 1 percent slopes	30	IIw-3	87
DnA	Dinuba fine sandy loam, shallow, 0 to 1 percent slopes	30	IVs-3	94
DoA	Dinuba fine sandy loam, deep, 0 to 1 percent slopes	30	IIw-3	87
DpA	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	30	IIw-3	87
DrA	Dinuba sandy loam, 0 to 1 percent slopes	32	IIw-3	87
DsA	Dinuba sandy loam, shallow, 0 to 1 percent slopes	32	IVs 3	94
DtA	Dinuba sandy loam, deep, 0 to 1 percent slopes	32	IIw-3	87
DuA	Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes	32	IIIw-3	90
DwA	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes	32	IIw-3	87
DxA	Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes	32	IVs-8	94
DyA	Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes	32	IVs 3	94
DzA	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes	34	IIIw-6	90
EcF	Exchequer rocky loam, 30 to 60 percent slopes	34	VIIe-3	96
ErD	Exchequer and Auburn rocky soils, 8 to 30 percent slopes	34	VIIe 3	96
ExB	Exchequer and Auburn soils, 3 to 8 percent slopes	34	VIe-3	95
ExD	Exchequer and Auburn soils, 8 to 30 percent slopes	34	VIe-3	95
FoA	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes	34	IIIw-6	90
FpA	Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	34	IIIs-8	92
FrA	Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	36	IVs-8	94
FsA	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	36	VIs-8	96
FtA	Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes	36	IIIs-8	92
FuA	Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes	36	IVs-8	94
FvA	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes	36	VIs-8	96
FwA	Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes	36	IIIs-8	92
FxA	Fresno-Dinuba sandy loans, moderately saline-alkali, 0 to 1 percent slopes	36	IVs-8	94
GfA	Grangeville fine sandy loam, 0 to 1 percent slopes	38	IIw-2	87
GgA	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	38	IIw-2	87
GhA	Grangeville sandy loam, 0 to 1 percent slopes	38	IIw-2	87
GkA	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes	38	IIw-2	87
GmA	Grangeville very fine sandy loam, 0 to 1 percent slopes	38	IIw-2	87
GnA	Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	38	IIw-2	87
GoA	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	38	IIIw-6	90
GrA	Greenfield fine sandy loam, 0 to 3 percent slopes	38	I-1	86
GsA	Greenfield sandy loam, 0 to 3 percent slopes	38	I-1	86
GsB	Greenfield sandy loam, 3 to 8 percent slopes	40	IIe-1	87

GUIDE TO MAPPING UNITS AND CAPABILITY UNITS—Continued

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page
GvA	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes	40	IIs-3	88
HaB	Toomes rocky loam, 0 to 8 percent slopes	64	VIIe-9	97
HbA	Hanford fine sandy loam, 0 to 3 percent slopes	40	I-1	86
HbmA	Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes	40	IIIs-4	91
HbpA	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes	40	I-1	86
HbsA	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes	40	I-1	86
HcA	Hanford gravelly sandy loam, 0 to 3 percent slopes	40	IIIs-4	91
HdA	Hanford sandy loam, 0 to 3 percent slopes	40	I-1	86
HdB	Hanford sandy loam, 3 to 8 percent slopes	40	IIe-1	87
HdC	Hanford sandy loam, 8 to 15 percent slopes	42	IVe-1	92
HddA	Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes	42	IIw-2	87
HdmA	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes	42	IIIs-4	91
HdpA	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes	42	IIs-3	88
HdsA	Hanford sandy loam, deep over silt, 0 to 1 percent slopes	42	I-1	86
HeA	Hanford very fine sandy loam, 0 to 1 percent slopes	42	I-1	86
HfA	Hilmar loamy sand, 0 to 1 percent slopes	42	IIIw-4	90
HfdA	Hilmar loamy sand, deep, 0 to 1 percent slopes	42	IIIw-4	90
HfeA	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes	44	IVw-4	93
HkaA	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes	44	IVw-4	93
HkbA	Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes	44	IIIw-4	90
HmA	Hilmar sand, 0 to 3 percent slopes	44	IIIw-4	90
HnA	Honcut clay loam, 0 to 1 percent slopes	44	I-1	86
HoA	Honcut fine sandy loam, 0 to 1 percent slopes	44	I-1	86
HpA	Honcut loam, 0 to 1 percent slopes	44	I-1	86
HrA	Honcut sandy loam, 0 to 1 percent slopes	44	I-1	86
HsB	Hopeton clay, 3 to 8 percent slopes	44	IIIs-5	91
HtA	Hopeton clay loam, 0 to 3 percent slopes	44	IIIs-3	91
HtB	Hopeton clay loam, 3 to 8 percent slopes	44	IVe-3	92
HuA	Hopeton loam, 0 to 3 percent slopes	46	IIIs-3	91
HuB	Hopeton loam, 3 to 8 percent slopes	46	IVe-3	92
HvB	Hornitos fine sandy loam, 3 to 8 percent slopes	46	VIIe-9	97
HvD	Hornitos fine sandy loam, 8 to 30 percent slopes	46	VIIe-9	97
HyB	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes	46	VIIe-9	97
HyD	Hornitos gravely fine sandy loam, 8 to 30 percent slopes	46	VIIe-9	97
KeB	Keyes cobbly clay loam, 0 to 8 percent slopes	46	VIe-9	96
KgB	Keyes gravelly clay loam, 0 to 8 percent slopes	46	IVe-3	92
La	Lava and sandstone rockland	46	VIIIs-1	97
MaA	Madera loam, 0 to 2 percent slopes	46	IVs-3	94
MdA	Madera sandy loam, 0 to 2 percent slopes	48	IVs-3	94
MdB	Madera sandy loam, 2 to 4 percent slopes	48	IVe-3	94
MeA	Madera-Alamo complex, 0 to 2 percent slopes	48	IVs-3	94
MkA	Meikle clay, 0 to 1 percent slopes	48	IIIw-5	90
MmA	Modesto clay loam, 0 to 1 percent slopes	48	IIs-7	88
MnA	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes	48	IIs-6	88
MoA	Modesto loam, 0 to 1 percent slopes	48	IIs-7	88
MpA	Modesto loam, slightly saline-alkali, 0 to 1 percent slopes	48	IIs-6	88
MtA	Montpellier coarse sandy loam, 0 to 3 percent slopes	50	IIIs-3	91
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes	50	IVe-3	92
MtC	Montpellier coarse sandy loam, 8 to 15 percent slopes	50	IVe-3	92
MtC2	Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded	50	VIe-3	95
MtD2	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded	50	VIe-9	96
MtD3	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded	50	VIe-9	96
MvA	Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes	50	IIIw-3	90
OaA	Oakdale sandy loam, 0 to 3 percent slopes	50	I-1	86
PaA	Paulsell clay, 0 to 1 percent slopes	50	IIIw-5	90
PcB	Pentz cobbly loam, very shallow, 0 to 8 percent slopes	50	VIIe-9	97
PcD	Pentz cobbly loam, very shallow, 8 to 30 percent slopes	52	VIIe-9	97
PeB	Pentz gravelly loam, 3 to 8 percent slopes	52	VIe-3	95
PeD	Pentz gravelly loam, 8 to 30 percent slopes	52	VIe-3	95
PeF	Pentz gravelly loam, 30 to 75 percent slopes	52	VIIe-3	96
PfB	Pentz loam, 3 to 8 percent slopes	52	VIe-3	95
PfD	Pentz loam, 8 to 30 percent slopes	52	VIe-3	95
PfE	Pentz loam, 30 to 45 percent slopes	52	VIIe-3	96
PmB	Pentz loam, moderately deep, 3 to 8 percent slopes	52	IIIe-1	89
PmC	Pentz loam, moderately deep, 8 to 15 percent slopes	52	IVe-1	92
PmC2	Pentz loam, moderately deep, 8 to 15 percent slopes, eroded	52	IVe-1	92
PmD	Pentz loam, moderately deep, 15 to 30 percent slopes	52	VIe-3	95
PmD2	Pentz loam, moderately deep, 15 to 30 percent slopes, eroded	52	VIe-3	95
PsB	Pentz sandy loam, 3 to 8 percent slopes	52	VIe-3	95
PpB	Pentz-Redding gravelly loams, 0 to 8 percent slopes	54	VIe-9	96
PtB	Peters clay, 0 to 8 percent slopes	54	IIIs-5	91
PtC	Peters clay, 8 to 15 percent slopes	54	IVe-5	93
PvB	Peters cobbly clay, 0 to 8 percent slopes	54	IIIs-5	91
PvC	Peters cobbly clay, 8 to 15 percent slopes	54	IVe-5	93

GUIDE TO MAPPING UNITS AND CAPABILITY UNITS—Continued

Map symbol	Mapping unit	Page	Capability unit: Symbol	Capability unit: Page
PxB	Peters-Pentz complex, 0 to 8 percent slopes	54	VIe–3	95
PxC	Peters-Pentz complex, 8 to 15 percent slopes	54	VIe–3	95
RaA	Raynor clay, 0 to 3 percent slopes	54	IIIs–5	91
RaB	Raynor clay, 3 to 8 percent slopes	56	IIIs–5	91
RaC	Raynor clay, 8 to 15 percent slopes	56	IVe–5	93
RbB	Raynor cobbly clay, 0 to 8 percent slopes	56	IIIs–5	91
RbC	Raynor cobbly clay, 8 to 15 percent slopes	56	IVe–5	93
RcB	Redding cobbly loam, 0 to 8 percent slopes	56	VIe–9	96
RcC	Redding cobbly loam, 8 to 15 percent slopes	56	VIe–9	96
RdB	Redding gravelly loam, 0 to 8 percent slopes	56	IVe–3	92
ReA	Rocklin sandy loam, 0 to 3 percent slopes	58	IIIs–3	91
ReB	Rocklin sandy loam, 3 to 8 percent slopes	58	IVe–3	92
RfA	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes	58	VIw–6	96
RgA	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes	58	VIw–6	96
RkA	Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes	58	IVw–6	93
RnA	Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes	58	IVs–8	94
RoA	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes	58	VIw–6	96
Rr	Riverwash	56	VIIIs–1	97
RtA	Ryer clay, 0 to 1 percent slopes	60	IIIs–5	91
RvA	Ryer clay loam, 0 to 1 percent slopes	60	IIs–7	88
RyA	Ryer loam, 0 to 1 percent slopes	60	IIs–7	88
SaA	San Joaquin sandy loams, 0 to 3 percent slopes	60	IVs–3	94
SaB	San Joaquin sandy loams, 3 to 8 percent slopes	60	IVe–3	92
Sc	Schist rockland	60	VIIIs 1	97
SmA	San Joaquin and Madera soils, 0 to 3 percent slopes	60	IVs–3	94
SnA	Snelling sandy loam, 0 to 3 percent slopes	60	IIs–7	88
SnB	Snelling sandy loam, 3 to 8 percent slopes	62	IIe–1	87
SwA	Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes	62	IIIw–3	90
TbA	Temple loam, overwashed, 0 to 1 percent slopes	62	IIw–2	87
TcA	Temple loam, overwashed, slightly saline, 0 to 1 percent slopes	62	IIw–2	87
TeA	Temple silty clay, slightly saline, 0 to 1 percent slopes	62	IIIw–5	90
TfA	Temple silty clay, moderately saline, 0 to 1 percent slopes	62	IIIw–5	90
TgA	Temple silty clay loam, 0 to 1 percent slopes	62	IIw–2	87
ThA	Temple silty clay loam, slightly saline, 0 to 1 percent slopes	64	IIw–2	87
TkA	Temple silty clay loam, moderately saline, 0 to 1 percent slopes	64	IIIw–6	90
TmA	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	64	IIs–6	88
TnA	Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	64	IIIs 6	92
ToA	Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	64	IVs–6	94
TpA	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes	64	IIs–6	88
TrA	Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes	66	IIIs–6	92
TsA	Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes	66	IVs 6	94
Tt	Tuff rockland	66	VIIIs–1	97
TuA	Tujunga loamy sand, 0 to 3 percent slopes	66	IIIe–4	89
TuB	Tujunga loamy sand, 3 to 5 percent slopes	66	IIIe–4	89
TvA	Tujunga sand, 0 to 3 percent slopes	66	IVe 4	93
Tx	Terrace escarpments	64	VIIIs–1	97
WaA	Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes	66	IIIs–8	92
WbA	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	66	IVs–8	94
WcA	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes	68	VIs–8	96
WdA	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes	68	IIIs 8	92
WeA	Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes	68	IVs–8	94
WhD	Whiterock rocky silt loam, 8 to 30 percent slopes	68	VIIe–3	96
WhF	Whiterock rocky silt loam, 30 to 60 percent slopes	68	VIIe–3	96
WkB	Whiterock silt loam, 0 to 8 percent slopes	68	VIIe–3	96
WmB	Whitney sandy loams, 3 to 8 percent slopes	68	IIIe–1	89
WmC	Whitney sandy loams, 8 to 15 percent slopes	68	IVe–1	92
WmC2	Whitney sandy loams, 8 to 15 percent slopes, eroded	68	IVe–1	92
WmD	Whitney sandy loams, 15 to 30 percent slopes	68	VIe 4	95
WmD2	Whitney sandy loams, 15 to 30 percent slopes, eroded	70	VIe 4	95
WmE2	Whitney sandy loams, 30 to 45 percent slopes, eroded	70	VIIe–3	96
WrA	Whitney and Rocklin sandy loams, 0 to 3 percent slopes	70	IIIe–1	89
WrB	Whitney and Rocklin sandy loams, 3 to 8 percent slopes	70	IIIe–1	89
WrC	Whitney and Rocklin sandy loams, 8 to 15 percent slopes	70	IVe–1	92
WtA	Wyman clay loam, 0 to 1 percent slopes	70	I–1	86
WvA	Wyman loam, 0 to 1 percent slopes	70	I–1	86
WyA	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes	70	IIIs–3	91
YkA	Yokohl loam, 0 to 1 percent slopes	72	IVs–3	94
YoA	Yokohl clay loam, 0 to 3 percent slopes	72	IVs–3	94
ZaB	Zaca clay, 3 to 8 percent slopes	72	IIIs–5	91
ZaC	Zaca clay, 8 to 15 percent slopes	72	IVe–5	93
ZaD	Zaca clay, 15 to 30 percent slopes	72	IVe–5	93

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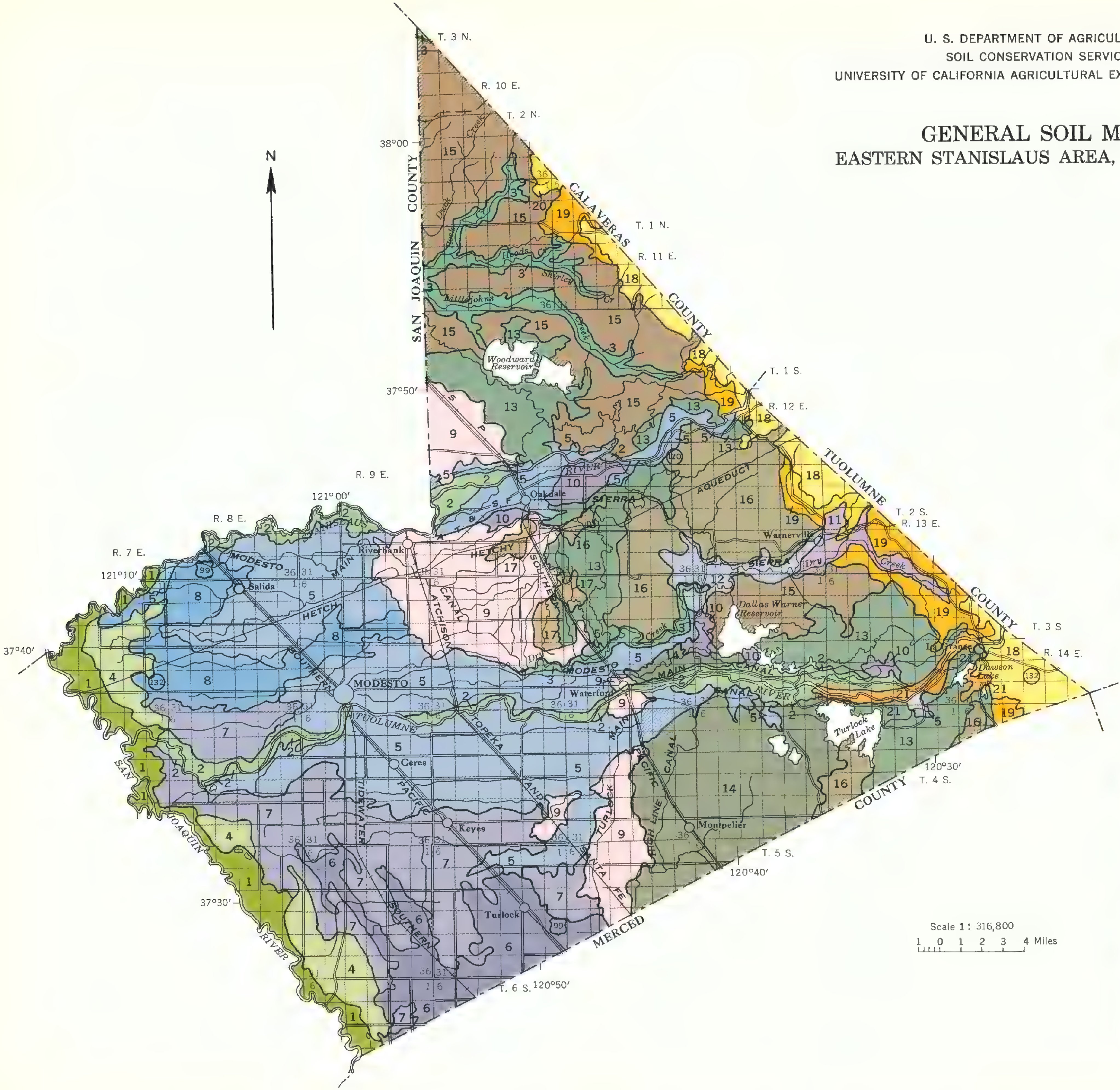
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
EASTERN STANISLAUS AREA, CALIFORNIA



Scale 1: 316,800
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

SOILS OF THE RECENT ALLUVIAL FLOOD PLAINS

1 Columbia-Temple association: Deep, imperfectly drained to poorly drained soils on the San Joaquin River flood plains.

2 Grangeville-Tujunga association: Deep, well-drained to imperfectly drained soils on the Stanislaus and Tuolumne River flood plains.

3 Honcut-Wyman association: Deep, well-drained to moderately well drained soils on flood plains and low terraces of Dry Creek and other minor streams.

SOILS OF THE BASIN LANDS

4 Waukena-Fresno association: Saline-alkali soils of the basin lands.

SOILS OF THE YOUNG ALLUVIAL FANS

5 Hanford (Ripperdan)-Tujunga association: Deep, well-drained soils on alluvial fans of the Stanislaus and Tuolumne Rivers.

6 Hilmar-Delhi association: Deep, wind-modified, coarse-textured soils on alluvial fans of the Stanislaus and Tuolumne Rivers.

7 Dinuba-Hanford association: Moderately deep to deep, well drained to imperfectly drained soils on fans of the Stanislaus and Tuolumne Rivers.

8 Modesto-Chualar association: Deep, slowly permeable soils in the flat area between the fans of the Stanislaus and Tuolumne Rivers.

SOILS OF THE LOW ALLUVIAL TERRACES AND MODERATELY OLD FANS

9 San Joaquin-Madera association: Hardpan soils on moderately old fans and terraces.

10 Snelling association: Deep, well-drained, moderately permeable soils on moderately old fans and terraces.

11 Ryer-Yokohl association: Deep, well-drained, slowly permeable or hardpan soils on moderately old terraces along Dry Creek.

12 Paulsell association: Deep, clay soils on lacustrine deposits in Paulsell Valley.

SOILS OF THE HIGH ALLUVIAL TERRACES, PARTIALLY ERODED TO ROLLING HILLS

13 Montpellier-Whitney association: Deep, slowly permeable soils on high terraces, and shallow to moderately deep soils on rolling, eroded terraces.

14 Whitney-Rocklin association: Shallow to moderately deep hardpan soils on high terraces, and shallow to moderately deep soils on eroded terraces.

15 Redding-Pentz-Peters association: Reddish, gravelly hardpan soils on high terraces, and shallow or clay soils on sloping terrace sides.

16 Keyes-Pentz-Peters association: Hardpan soils on high terraces, and shallow or clay soils on sloping terrace sides.

17 Hopeton-Peters association: Shallow to moderately deep, medium to fine-textured soils on lacustrine or mixed sediments.

UPLAND SOILS OF THE SIERRA NEVADA FOOTHILLS

18 Auburn-Exchequer association: Shallow or very shallow, rocky upland soils of moderate to low fertility.

19 Hornitos-Amador association: Shallow or very shallow upland soils of very low fertility.

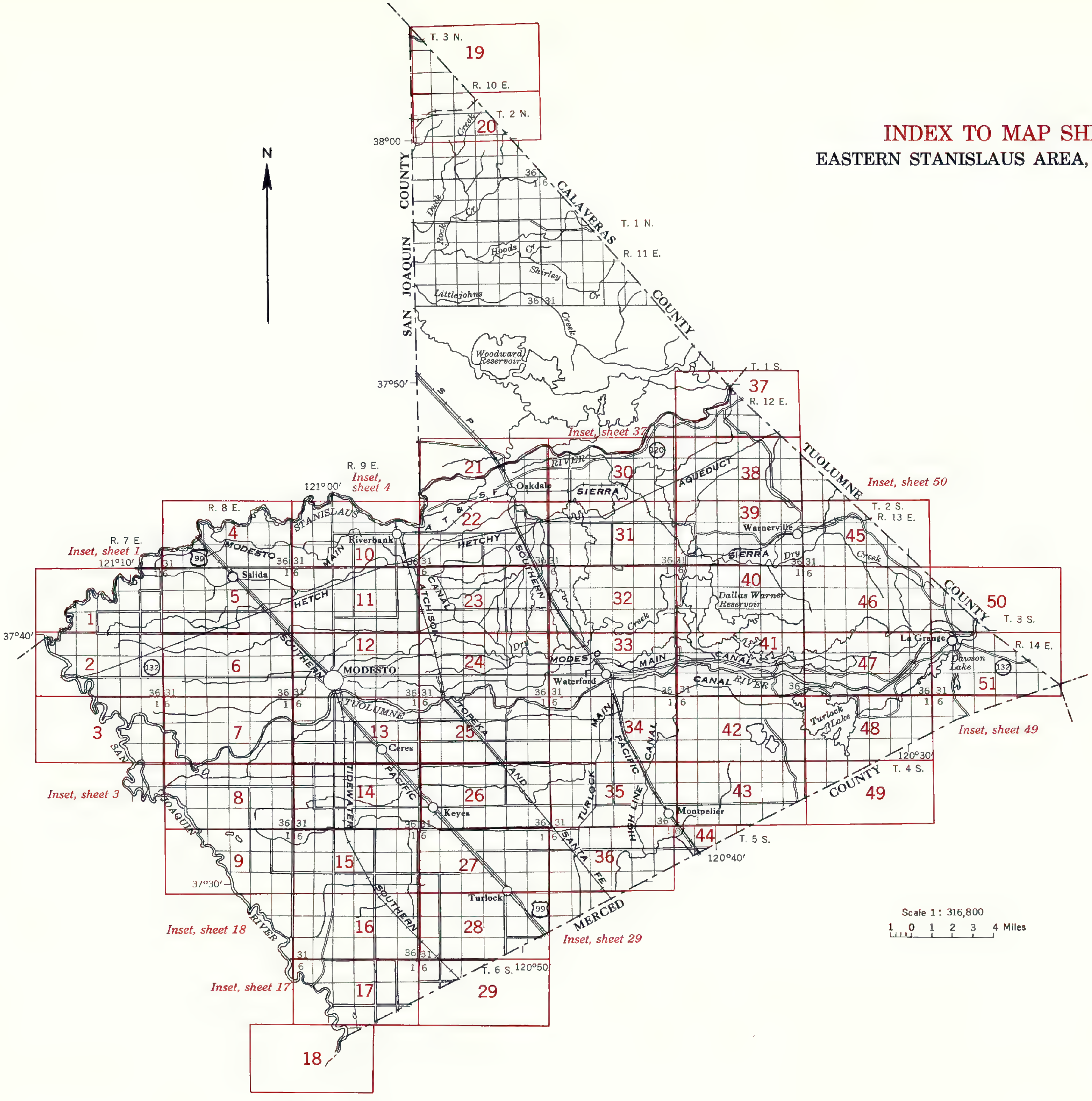
20 Zaca association: Calcareous clay soils of the uplands.

DREDGE AND MINE TAILINGS

21 Dredge and mine tailings: Gravelly and cobbly debris.

1961

INDEX TO MAP SHEETS
EASTERN STANISLAUS AREA, CALIFORNIA



SOIL LEGEND

Each soil symbol consists of letters or a combination of letters and numbers. The first capital letter is the initial of the soil series name. The second capital letter shows the class of slope. A final number, 2 or 3, shows that the soil is named as eroded or severely eroded.

SYMBOL	NAME
AcA	Alamo clay, 0 to 1 percent slopes
AgB	Amador gravelly loam, 0 to 8 percent slopes
AmB	Amador loam, 0 to 8 percent slopes
AmD	Amador loam, 8 to 30 percent slopes
AmF	Amador loam, 30 to 60 percent slopes
AnA	Anderson gravelly fine sandy loam, 0 to 3 percent slopes
AnB	Anderson gravelly fine sandy loam, 3 to 8 percent slopes
AoA	Anderson gravelly fine sandy loam, channeled, 0 to 3 percent slopes
AuB	Auburn clay loam, 3 to 8 percent slopes
AuD	Auburn clay loam, 8 to 20 percent slopes
BcA	Bear Creek clay loam, 0 to 3 percent slopes
BeA	Bear Creek gravelly clay loam, channeled, 0 to 3 percent slopes
BgA	Bear Creek gravelly loam, 0 to 3 percent slopes
BmA	Bear Creek loam, 0 to 3 percent slopes
CaA	Chualar sandy loam, 0 to 3 percent slopes
CbA	Chualar sandy loam, slightly saline-alkali, 0 to 3 percent slopes
CcA	Columbia fine sandy loam, 0 to 1 percent slopes
CdA	Columbia fine sandy loam, moderately saline, 0 to 1 percent slopes
CeA	Columbia loam, 0 to 1 percent slopes
CfA	Columbia silt loam, 0 to 1 percent slopes
CgA	Columbia silt loam, slightly saline, 0 to 1 percent slopes
ChA	Columbia silt loam, moderately deep over Fresno soils, slightly saline-alkali, 0 to 1 percent slopes
CkA	Columbia silt loam, moderately deep over Temple soils, 0 to 1 percent slopes
CmA	Columbia silt loam, moderately deep over Temple soils, slightly saline, 0 to 1 percent slopes
CnA	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes
CoA	Columbia silty clay loam, slightly saline, 0 to 1 percent slopes
CpA	Columbia soils, 0 to 1 percent slopes
CsB	Columbia soils, channeled, 0 to 8 percent slopes
CyB	Corning gravelly sandy loam, 3 to 8 percent slopes
CyC	Corning gravelly sandy loam, 8 to 15 percent slopes
CyD	Corning gravelly sandy loam, 15 to 30 percent slopes
DeA	Delhi loamy sand, 0 to 3 percent slopes
DeB	Delhi loamy sand, 3 to 8 percent slopes
DfA	Delhi loamy sand, moderately deep over clay, 0 to 3 percent slopes
DgA	Delhi loamy sand, silty substratum, 0 to 3 percent slopes
DhA	Delhi sand, 0 to 3 percent slopes
DhB	Delhi sand, 3 to 8 percent slopes
DkA	Dello loamy sand, 0 to 1 percent slopes
Dl	Dredge and mine tailings
DmA	Dinuba fine sandy loam, 0 to 1 percent slopes
DnA	Dinuba fine sandy loam, shallow, 0 to 1 percent slopes
DoA	Dinuba fine sandy loam, deep, 0 to 1 percent slopes
DpA	Dinuba fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
DrA	Dinuba sandy loam, 0 to 1 percent slopes
DsA	Dinuba sandy loam, shallow, 0 to 1 percent slopes
DtA	Dinuba sandy loam, deep, 0 to 1 percent slopes
DuA	Dinuba sandy loam, poorly drained variant, 0 to 1 percent slopes
DwA	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes
DxA	Dinuba sandy loam, moderately saline-alkali, 0 to 1 percent slopes
DyA	Dinuba sandy loam, shallow, slightly saline-alkali, 0 to 1 percent slopes
DzA	Dinuba sandy loam, very poorly drained variant, slightly saline-alkali, 0 to 1 percent slopes
EcF	Exchequer rocky loam, 30 to 60 percent slopes
ErD	Exchequer and Auburn rocky soils, 8 to 30 percent slopes
ExB	Exchequer and Auburn soils, 3 to 8 percent slopes
ExD	Exchequer and Auburn soils, 8 to 30 percent slopes

SYMBOL	NAME
FoA	Foster very fine sandy loam, very poorly drained, slightly saline-alkali, 0 to 1 percent slopes
FpA	Fresno fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
FrA	Fresno fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes
FsA	Fresno fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes
FtA	Fresno sandy loam, slightly saline-alkali, 0 to 1 percent slopes
FuA	Fresno sandy loam, moderately saline-alkali, 0 to 1 percent slopes
FvA	Fresno sandy loam, strongly saline-alkali, 0 to 1 percent slopes
FwA	Fresno-Dinuba sandy loams, slightly saline-alkali, 0 to 1 percent slopes
FxA	Fresno-Dinuba sandy loams, moderately saline-alkali, 0 to 1 percent slopes
GfA	Grangeville fine sandy loam, 0 to 1 percent slopes
GgA	Grangeville fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
GhA	Grangeville sandy loam, 0 to 1 percent slopes
GkA	Grangeville sandy loam, slightly saline-alkali, 0 to 1 percent slopes
GmA	Grangeville very fine sandy loam, 0 to 1 percent slopes
GnA	Grangeville very fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
GoA	Grangeville very fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes
GrA	Greenfield fine sandy loam, 0 to 3 percent slopes
GsA	Greenfield sandy loam, 0 to 3 percent slopes
GsB	Greenfield sandy loam, 3 to 8 percent slopes
GvA	Greenfield sandy loam, deep over hardpan, 0 to 3 percent slopes
HaB	Toomes rocky loam, 0 to 8 percent slopes
HbA	Hanford fine sandy loam, 0 to 3 percent slopes
HbmA	Hanford fine sandy loam, moderately deep over sand, 0 to 3 percent slopes
HbpA	Hanford fine sandy loam, moderately deep over silt, 0 to 1 percent slopes
HbsA	Hanford fine sandy loam, deep over silt, 0 to 1 percent slopes
HcA	Hanford gravelly sandy loam, 0 to 3 percent slopes
HdA	Hanford sandy loam, 0 to 3 percent slopes
HdB	Hanford sandy loam, 3 to 8 percent slopes
HdC	Hanford sandy loam, 8 to 15 percent slopes
HddA	Hanford sandy loam, poorly drained variant, 0 to 1 percent slopes
HdmA	Hanford sandy loam, moderately deep over sand, 0 to 3 percent slopes
HdpA	Hanford sandy loam, moderately deep over silt, 0 to 1 percent slopes
HdsA	Hanford sandy loam, deep over silt, 0 to 1 percent slopes
HeA	Hanford very fine sandy loam, 0 to 1 percent slopes
HfA	Hilmar loamy sand, 0 to 1 percent slopes
HfdA	Hilmar loamy sand, deep, 0 to 1 percent slopes
HfeA	Hilmar loamy sand, very poorly drained variant, moderately saline-alkali, 0 to 1 percent slopes
HkaA	Hilmar loamy sand, poorly drained, slightly saline-alkali, 0 to 1 percent slopes
HkbA	Hilmar loamy sand, slightly saline-alkali, 0 to 1 percent slopes
HmA	Hilmar sand, 0 to 3 percent slopes
HnA	Honcut clay loam, 0 to 1 percent slopes
HoA	Honcut fine sandy loam, 0 to 1 percent slopes
HpA	Honcut loam, 0 to 1 percent slopes
HrA	Honcut sandy loam, 0 to 1 percent slopes
HsB	Hopeton clay, 3 to 8 percent slopes
HtA	Hopeton clay loam, 0 to 3 percent slopes
HtB	Hopeton clay loam, 3 to 8 percent slopes
HuA	Hopeton loam, 0 to 3 percent slopes
HuB	Hopeton loam, 3 to 8 percent slopes
HvB	Hornitos fine sandy loam, 3 to 8 percent slopes
HvD	Hornitos fine sandy loam, 8 to 30 percent slopes
HyB	Hornitos gravelly fine sandy loam, 3 to 8 percent slopes
HyD	Hornitos gravelly fine sandy loam, 8 to 30 percent slopes

SYMBOL	NAME
KeB	Keyes cobbly clay loam, 0 to 8 percent slopes
KgB	Keyes gravelly clay loam, 0 to 8 percent slopes
La	Lava and sandstone rockland
MaA	Madera loam, 0 to 2 percent slopes
MdA	Madera sandy loam, 0 to 2 percent slopes
MdB	Madera sandy loam, 2 to 4 percent slopes
MeA	Madera-Alamo complex, 0 to 2 percent slopes
MkA	Meikle clay, 0 to 1 percent slopes
MmA	Modesto clay loam, 0 to 1 percent slopes
MnA	Modesto clay loam, slightly saline-alkali, 0 to 1 percent slopes
MoA	Modesto loam, 0 to 1 percent slopes
MpA	Modesto loam, slightly saline-alkali, 0 to 1 percent slopes
MtA	Montpellier coarse sandy loam, 0 to 3 percent slopes
MtB	Montpellier coarse sandy loam, 3 to 8 percent slopes
MtC	Montpellier coarse sandy loam, 8 to 15 percent slopes
MtC2	Montpellier coarse sandy loam, 8 to 15 percent slopes, eroded
MtD2	Montpellier coarse sandy loam, 15 to 30 percent slopes, eroded
MtD3	Montpellier coarse sandy loam, 15 to 30 percent slopes, severely eroded
MvA	Montpellier coarse sandy loam, poorly drained variant, 0 to 1 percent slopes
OaA	Oakdale sandy loam, 0 to 3 percent slopes
PaA	Paulsell clay, 0 to 1 percent slopes
PcB	Pentz cobbly loam, very shallow, 0 to 8 percent slopes
PcD	Pentz cobbly loam, very shallow, 8 to 30 percent slopes
PeB	Pentz gravelly loam, 3 to 8 percent slopes
PeD	Pentz gravelly loam, 8 to 30 percent slopes
PeF	Pentz gravelly loam, 30 to 75 percent slopes
PfB	Pentz loam, 3 to 8 percent slopes
PfD	Pentz loam, 8 to 30 percent slopes
PfE	Pentz loam, 30 to 45 percent slopes
PmB	Pentz loam, moderately deep, 3 to 8 percent slopes
PmC	Pentz loam, moderately deep, 8 to 15 percent slopes
PmC2	Pentz loam, moderately deep, 8 to 15 percent slopes, eroded
PmD	Pentz loam, moderately deep, 15 to 30 percent slopes
PmD2	Pentz loam, moderately deep, 15 to 30 percent slopes, eroded
PoB	Pentz sandy loam, 3 to 8 percent slopes
PpB	Pentz-Redding gravelly loams, 0 to 8 percent slopes
PtB	Peters clay, 0 to 8 percent slopes
PtC	Peters clay, 8 to 15 percent slopes
PvB	Peters cobbly clay, 0 to 8 percent slopes
PvC	Peters cobbly clay, 8 to 15 percent slopes
PxB	Peters-Pentz complex, 0 to 8 percent slopes
PxC	Peters-Pentz complex, 8 to 15 percent slopes
RaA	Raynor clay, 0 to 3 percent slopes
RaB	Raynor clay, 3 to 8 percent slopes
RaC	Raynor clay, 8 to 15 percent slopes
RbB	Raynor cobbly clay, 0 to 8 percent slopes
RbC	Raynor cobbly clay, 8 to 15 percent slopes
RcB	Redding cobbly loam, 0 to 8 percent slopes
RcC	Redding cobbly loam, 8 to 15 percent slopes
RdB	Redding gravelly loam, 0 to 8 percent slopes
ReA	Rocklin sandy loam, 0 to 3 percent slopes
ReB	Rocklin sandy loam, 3 to 8 percent slopes
RfA	Rossi clay, moderately saline-alkali, 0 to 1 percent slopes
RgA	Rossi clay, strongly saline-alkali, 0 to 1 percent slopes
RkA	Rossi clay loam, moderately saline-alkali, 0 to 1 percent slopes
RnA	Rossi-Waukena complex, moderately saline-alkali, 0 to 1 percent slopes
RoA	Rossi-Waukena complex, strongly saline-alkali, 0 to 1 percent slopes

SYMBOL	NAME
Rr	Riverwash
RtA	Ryer clay, 0 to 1 percent slopes
RvA	Ryer clay loam, 0 to 1 percent slopes
RyA	Ryer loam, 0 to 1 percent slopes
SaA	San Joaquin sandy loams, 0 to 3 percent slopes
SaB	San Joaquin sandy loams, 3 to 8 percent slopes
Sc	Schist rockland
SmA	San Joaquin and Madera soils, 0 to 3 percent slopes
SnA	Snelling sandy loam, 0 to 3 percent slopes
SnB	Snelling sandy loam, 3 to 8 percent slopes
SwA	Snelling sandy loam, poorly drained variant, 0 to 1 percent slopes
TbA	Temple loam, overwashed, 0 to 1 percent slopes
TcA	Temple loam, overwashed, slightly saline, 0 to 1 percent slopes
TdA	Temple loam, overwashed, moderately saline, 0 to 1 percent slopes
TeA	Temple silty clay, slightly saline, 0 to 1 percent slopes
TfA	Temple silty clay, moderately saline, 0 to 1 percent slopes
TgA	Temple silty clay loam, 0 to 1 percent slopes
ThA	Temple silty clay loam, slightly saline, 0 to 1 percent slopes
TkA	Temple silty clay loam, moderately saline, 0 to 1 percent slopes
TmA	Traver fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
TnA	Traver fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes
ToA	Traver fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes
TpA	Traver sandy loam, slightly saline-alkali, 0 to 1 percent slopes
TrA	Traver sandy loam, moderately saline-alkali, 0 to 1 percent slopes
TsA	Traver sandy loam, strongly saline-alkali, 0 to 1 percent slopes
Tt	Tuff rockland
TuA	Tujunga loamy sand, 0 to 3 percent slopes
TuB	Tujunga loamy sand, 3 to 5 percent slopes
TvA	Tujunga sand, 0 to 3 percent slopes
Tx	Terrace escarpments
WaA	Waukena fine sandy loam, slightly saline-alkali, 0 to 1 percent slopes
WbA	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes
WcA	Waukena fine sandy loam, strongly saline-alkali, 0 to 1 percent slopes
WdA	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes
WeA	Waukena sandy loam, moderately saline-alkali, 0 to 1 percent slopes
WhD	Whiterock rocky silt loam, 8 to 30 percent slopes
WhF	Whiterock rocky silt loam, 30 to 60 percent slopes
WkB	Whiterock silt loam, 0 to 8 percent slopes
WmB	Whitney sandy loams, 3 to 8 percent slopes
WmC	Whitney sandy loams, 8 to 15 percent slopes
WmC2	Whitney sandy loams, 8 to 15 percent slopes, eroded
WmD	Whitney sandy loams, 15 to 30 percent slopes
WmD2	Whitney sandy loams, 15 to 30 percent slopes, eroded
WmE2	Whitney sandy loams, 30 to 45 percent slopes, eroded
WrA	Whitney and Rocklin sandy loams, 0 to 3 percent slopes
WrB	Whitney and Rocklin sandy loams, 3 to 8 percent slopes
WrC	Whitney and Rocklin sandy loams, 8 to 15 percent slopes
WtA	Wyman clay loam, 0 to 1 percent slopes
WvA	Wyman loam, 0 to 1 percent slopes
WyA	Wyman loam, moderately deep over gravel, 0 to 1 percent slopes
YkA	Yokohl loam, 0 to 1 percent slopes
YoA	Yokohl clay loam, 0 to 3 percent slopes
ZaB	Zaca clay, 3 to 8 percent slopes
ZaC	Zaca clay, 8 to 15 percent slopes
ZaD	Zaca clay, 15 to 30 percent slopes

Soil map constructed 1961 by Cartographic Division, Soil Conservation Service, USDA, from 1950 and 1957 aerial photographs. Controlled mosaic based on California plane coordinate system, third zone, Lambert conformal conic projection, 1927 North American datum.

EASTERN STANISLAUS COUNTY, CALIFORNIA
CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

Windmills

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.
- Crossable with tillage implements
- Not crossable with tillage implements

Canals and ditches — CANAL, DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions — Large, Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Kitchen midden
- Gullies
- Saline spot
- Soil sample site

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 1

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

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0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

3

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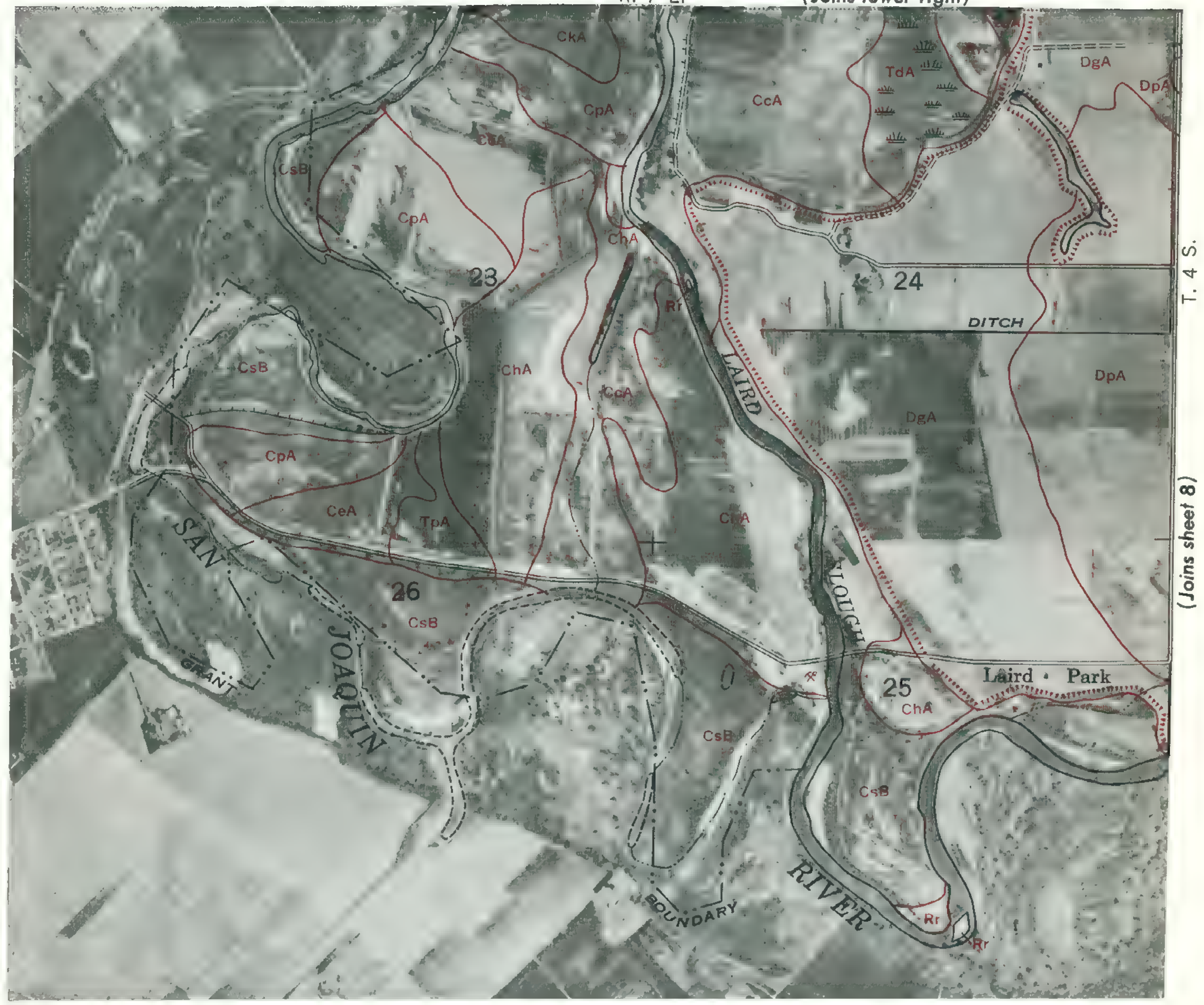
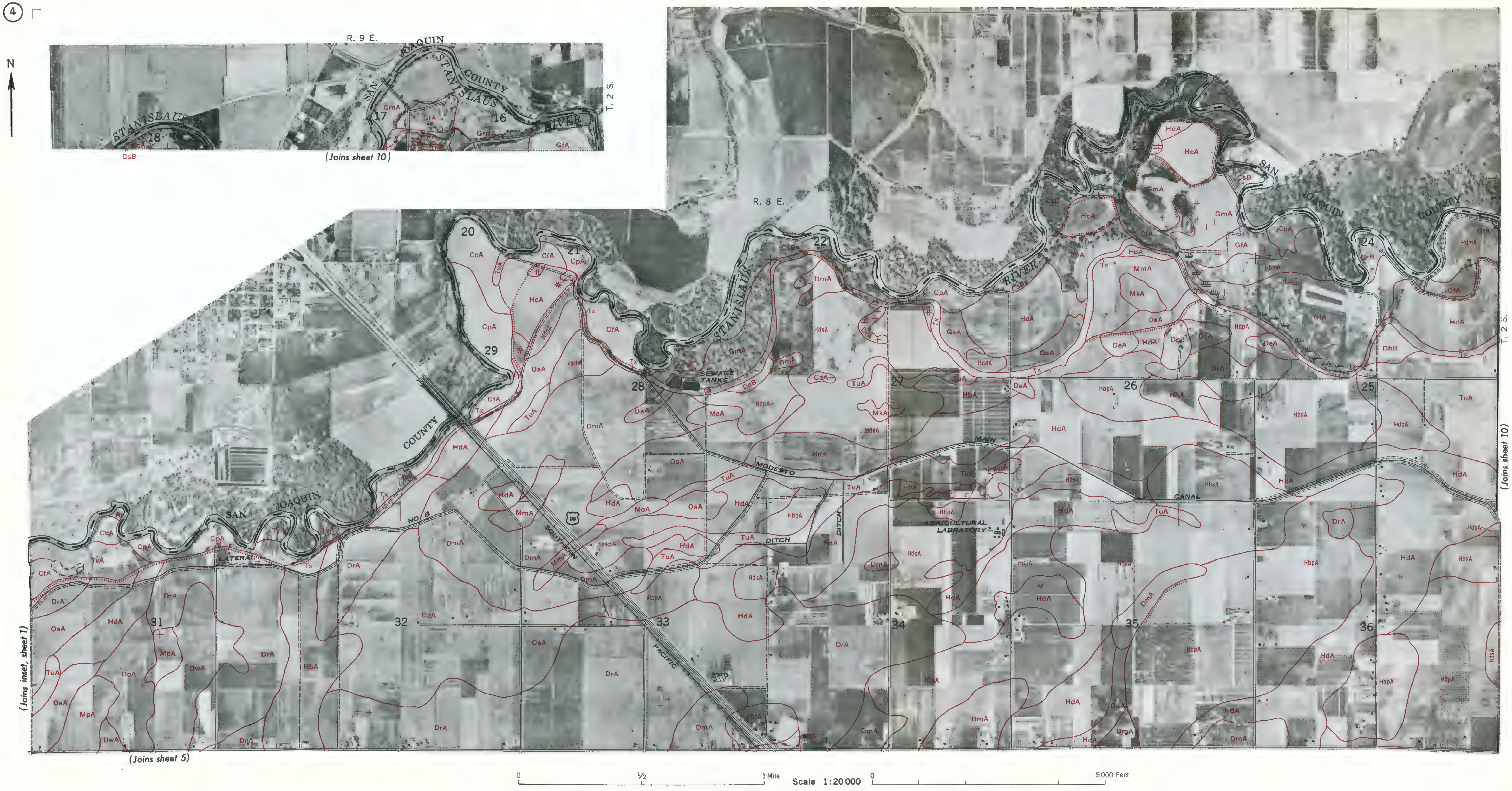


0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


4
N
R. 9 E.
T. 2 S.
(Joins sheet 10)
R. 8 E.
SAN JOAQUIN
STANISLAUS COUNTY
STANISLAUS RIVER
SEWAGE TANKS
MODESTO MAIN CANAL
LATERAL NO 8
TUA DITCH
AGRICULTURAL LABORATORY
SOUTHERN PACIFIC
(Joins inset, sheet 1)
(Joins sheet 5)
(Joins sheet 10)
0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

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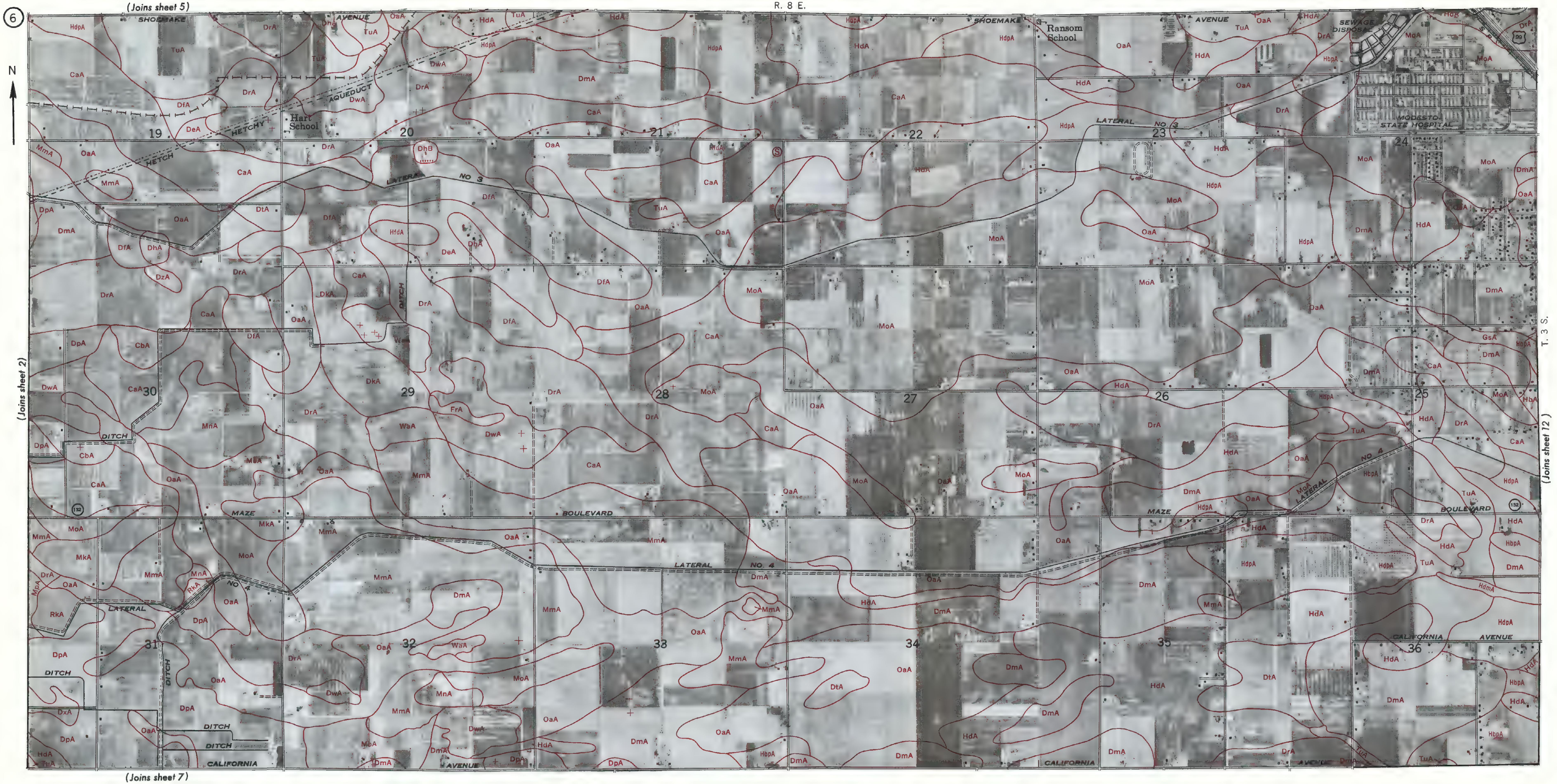
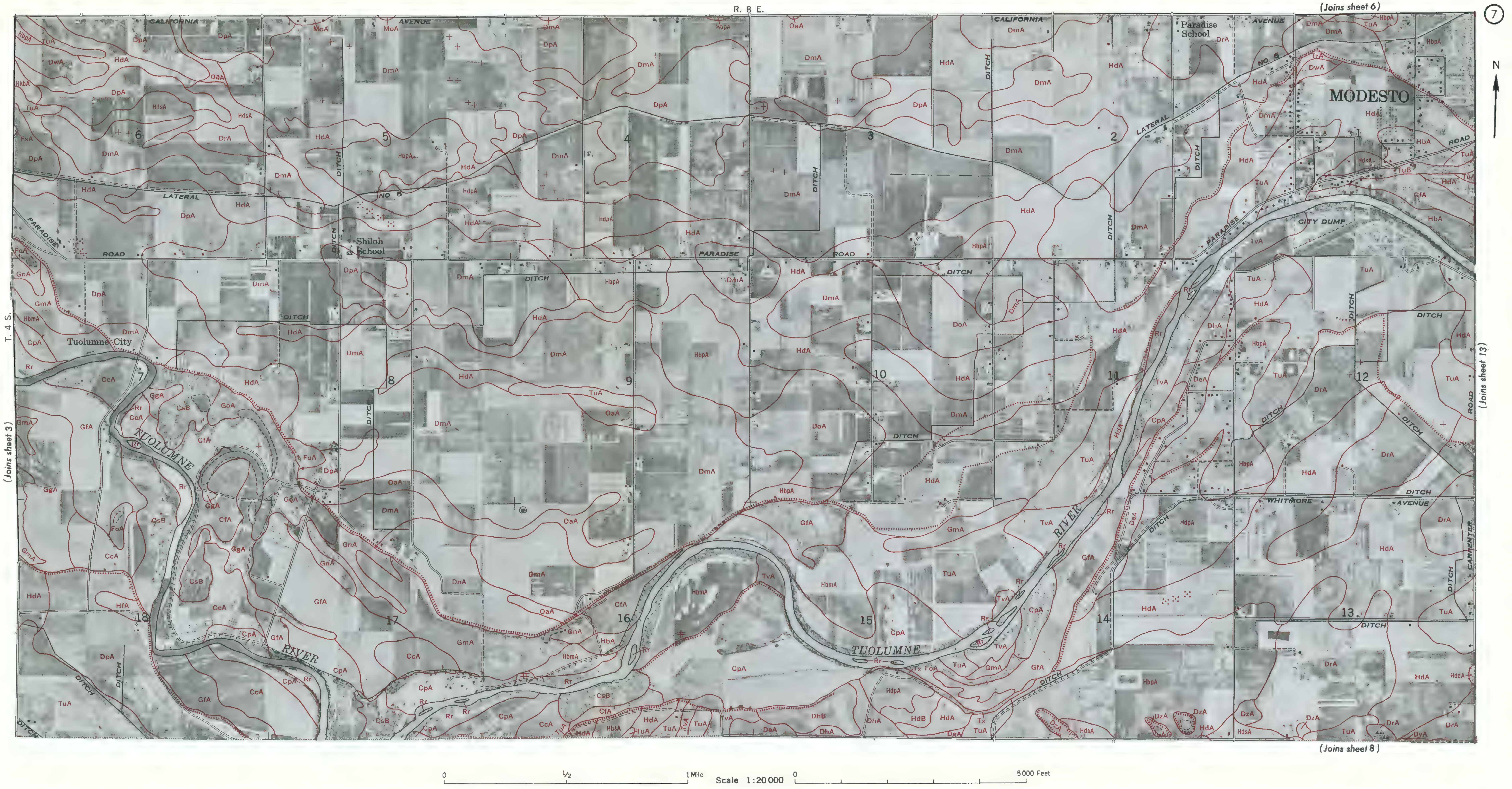
EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 6



0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 7



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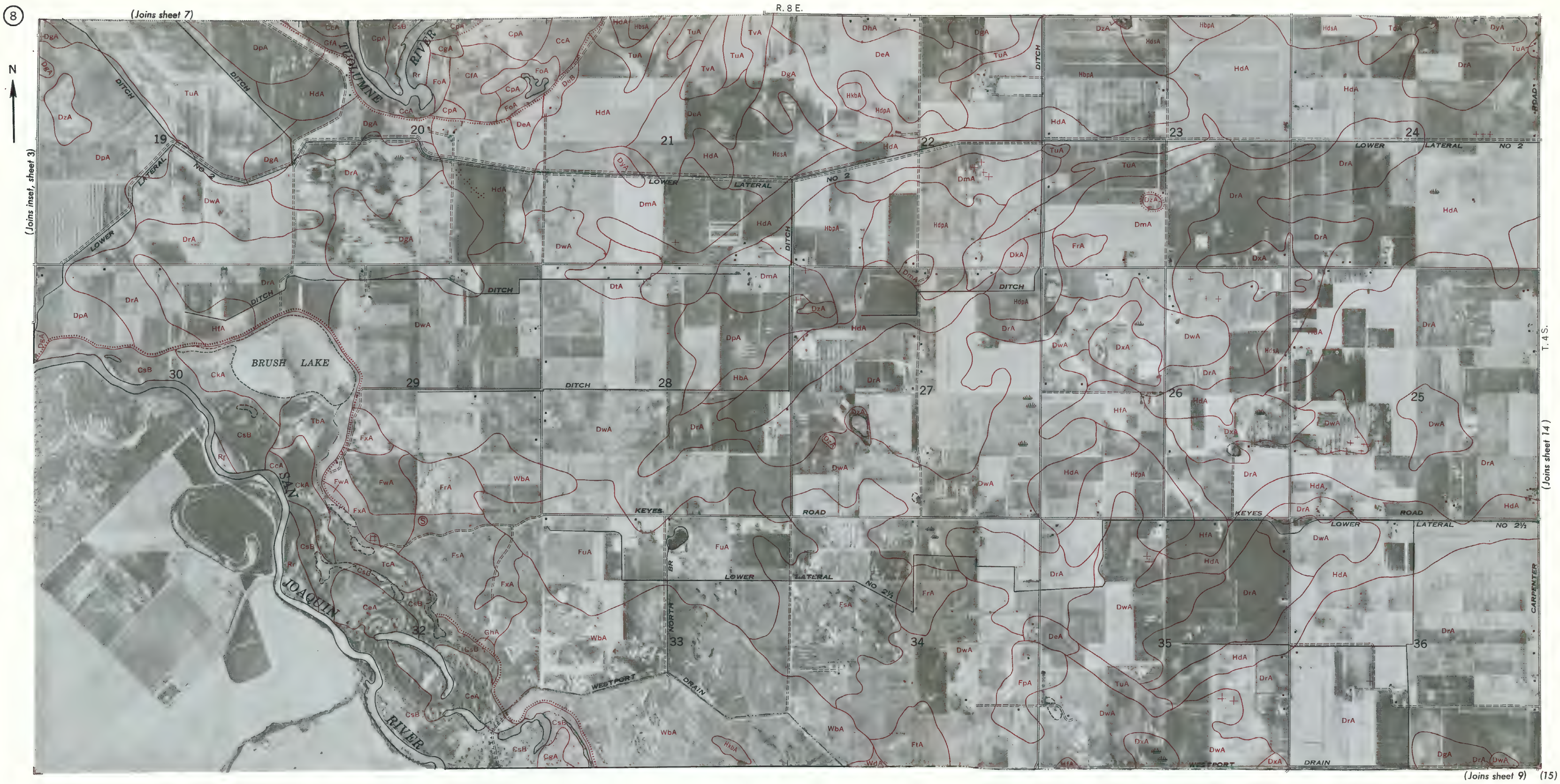

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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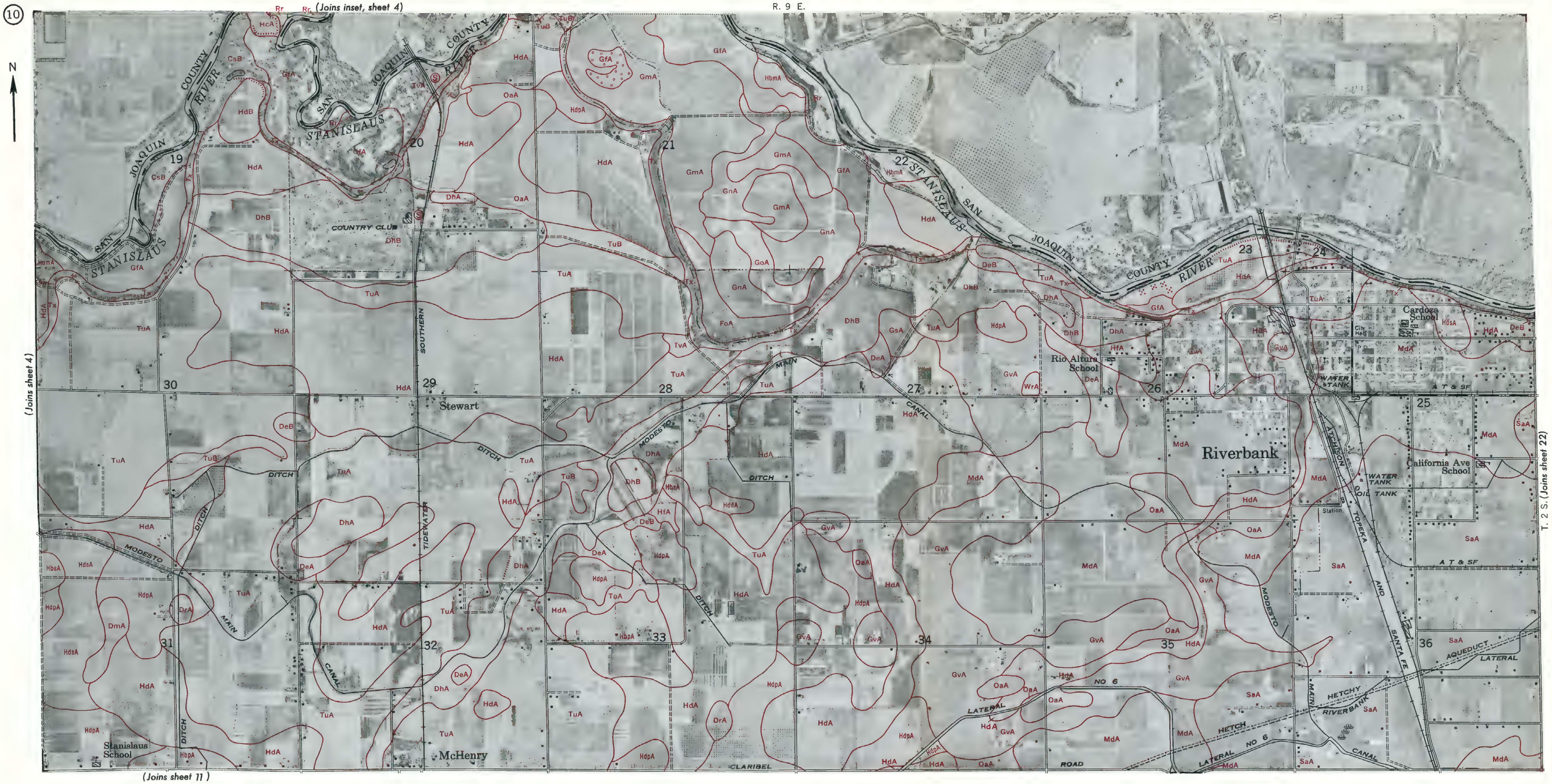
0 ½ 1 Mile Scale 1:20 000 0 5000 Feet



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 11

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

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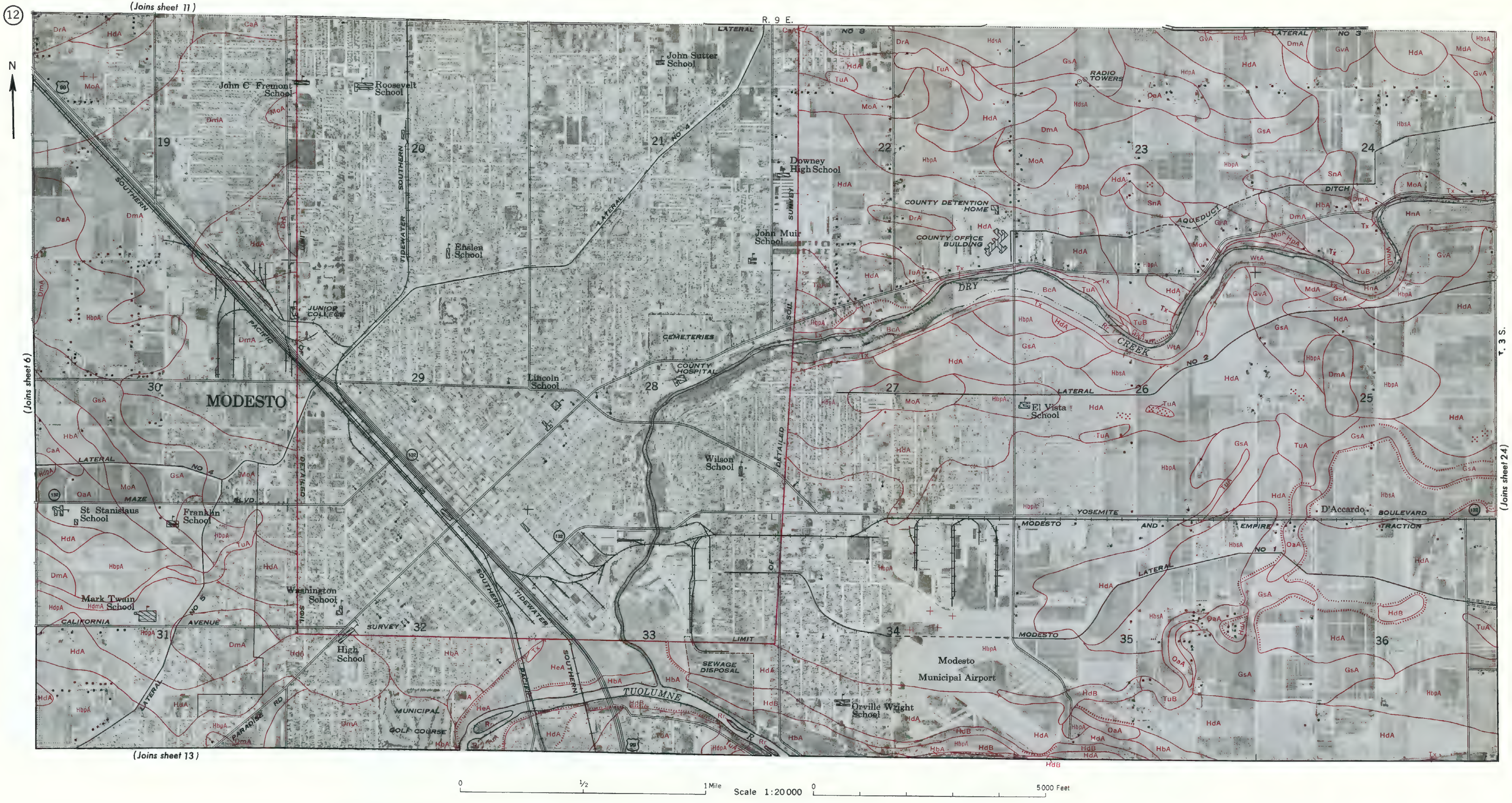
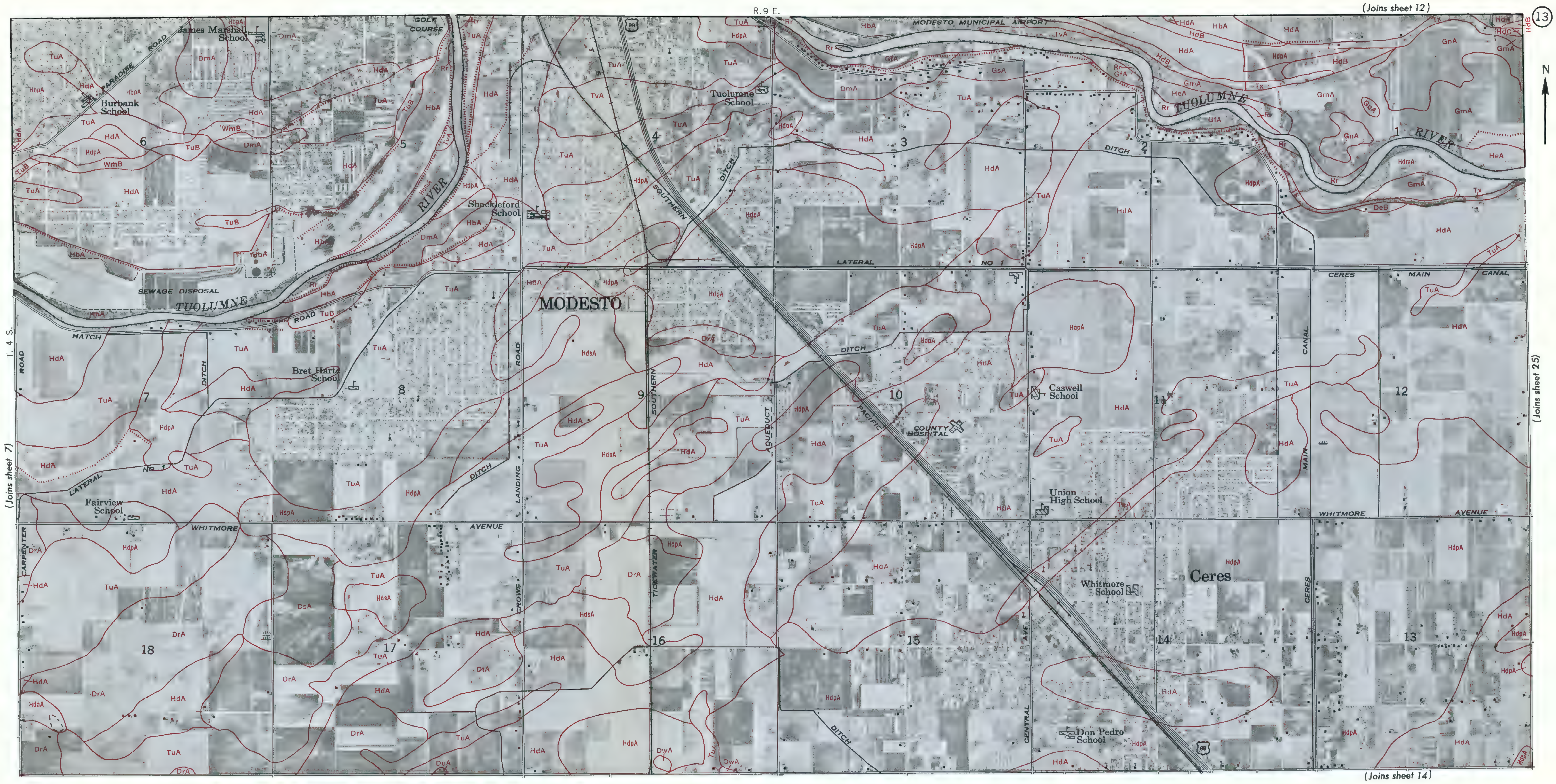
EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 12





Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

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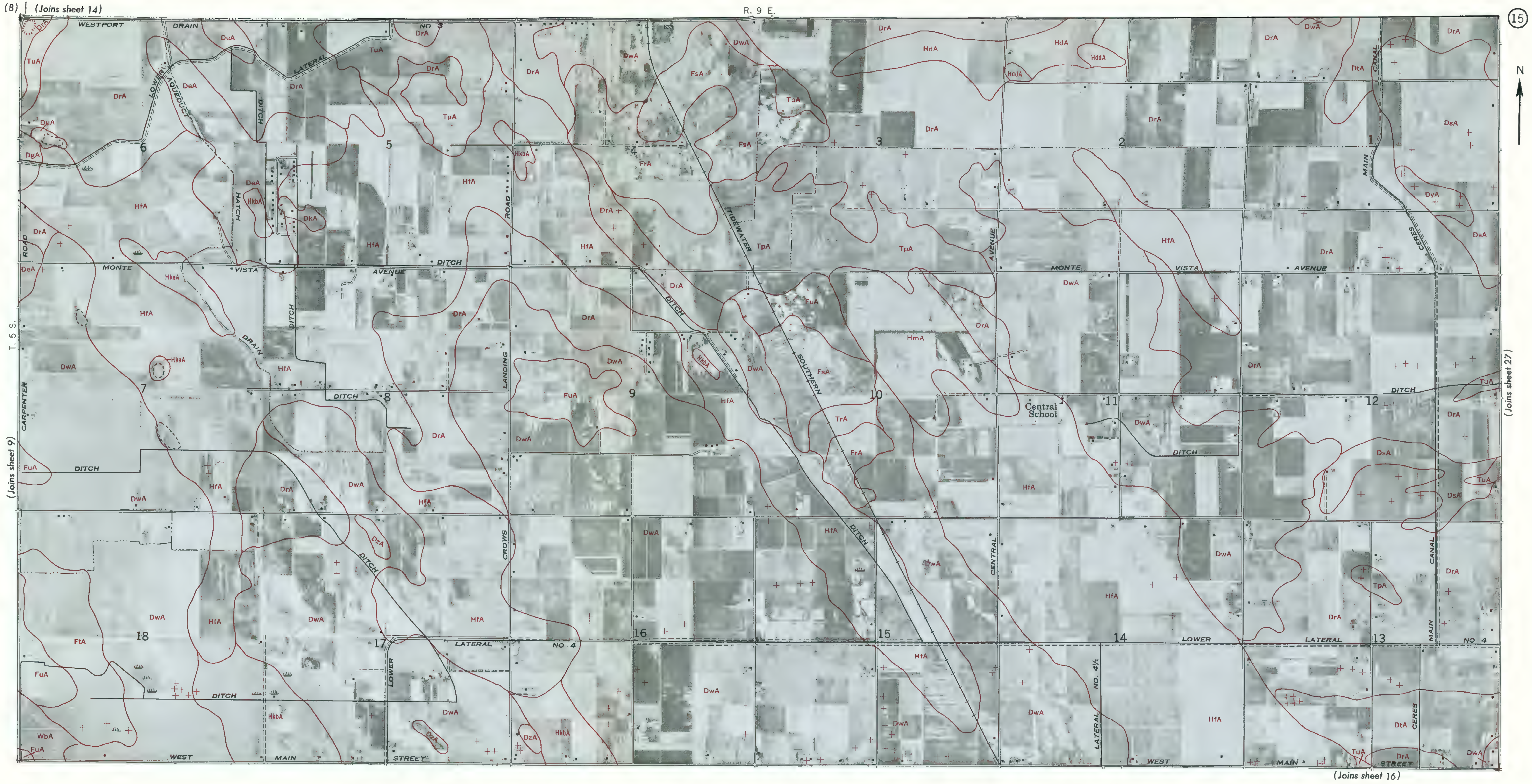
Scale 1:20000

0 ½ 1 Mile

0 5000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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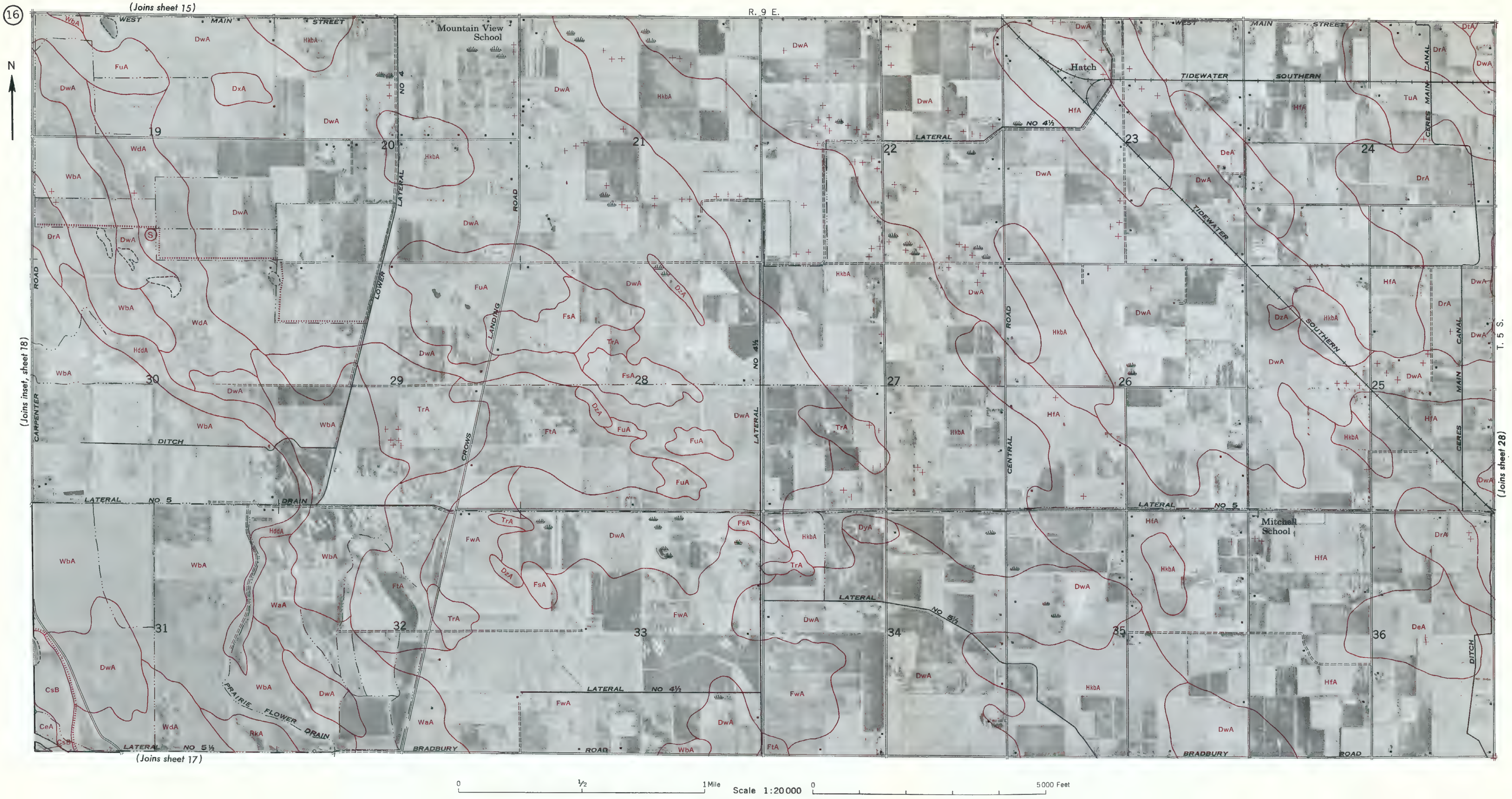
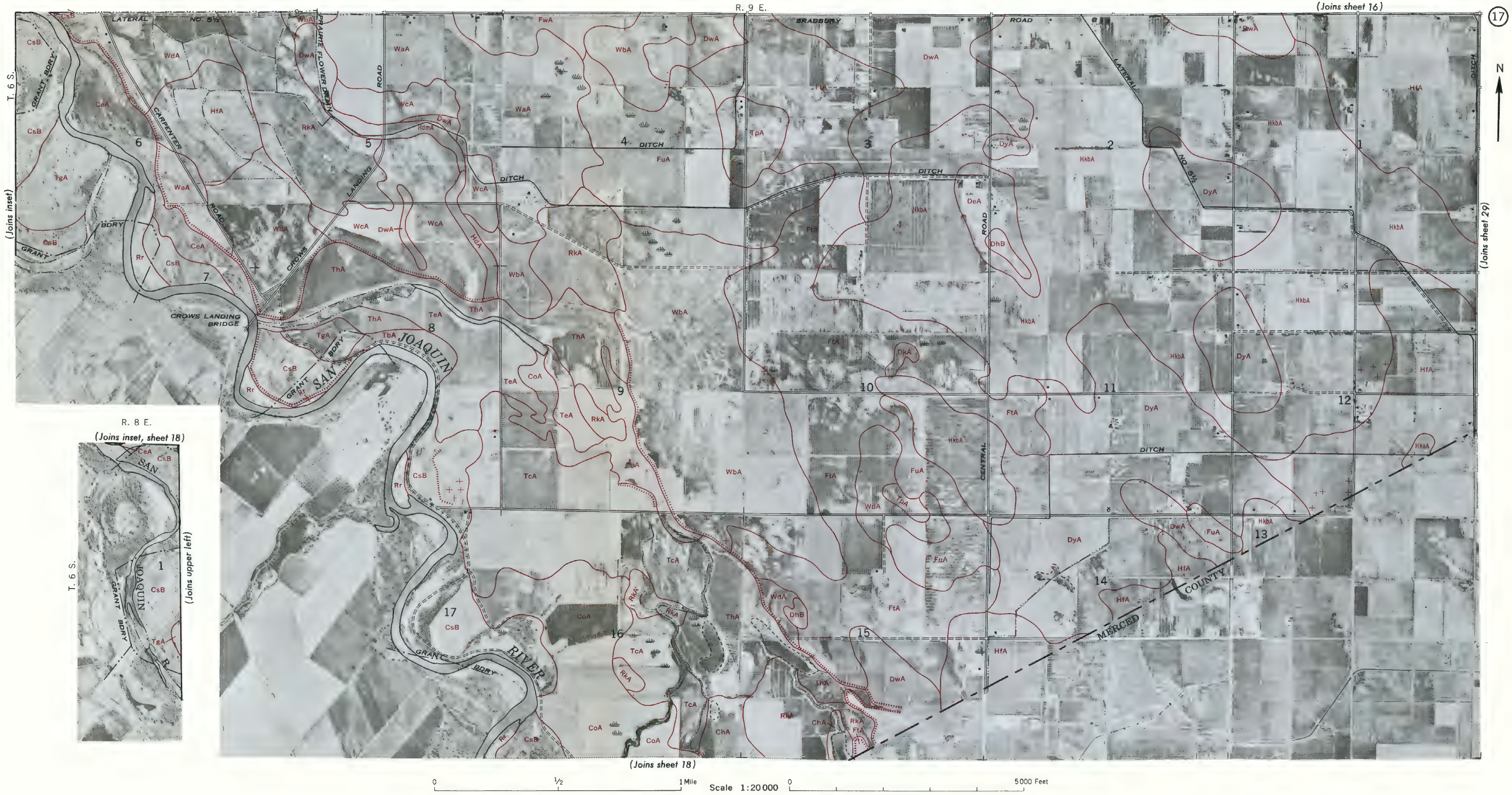

16
(Joins sheet 15)
R. 9 E.
N
WEST MAIN STREET
Mountain View School
Hatch
TIDEWATER SOUTHERN
CERES MAIN CANAL
NO 4 LOWER LATERAL
ROAD
NO 4½ LATERAL
CARPENTER ROAD
DITCH
LATERAL NO 5
DRAIN
CROWS LANDING ROAD
NO 4½ LATERAL
CENTRAL ROAD
TIDEWATER SOUTHERN
Mitchell School
LATERAL NO 5½
PRAIRIE FLOWER DRAIN
LATERAL NO 5½
BRADBURY ROAD
LATERAL NO 4½
CERES DITCH
(Joins inset, sheet 18)
(Joins sheet 28)
(Joins sheet 17)
T. 5 S.
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
0
½
1 Mile
Scale 1:20 000
0
5000 Feet



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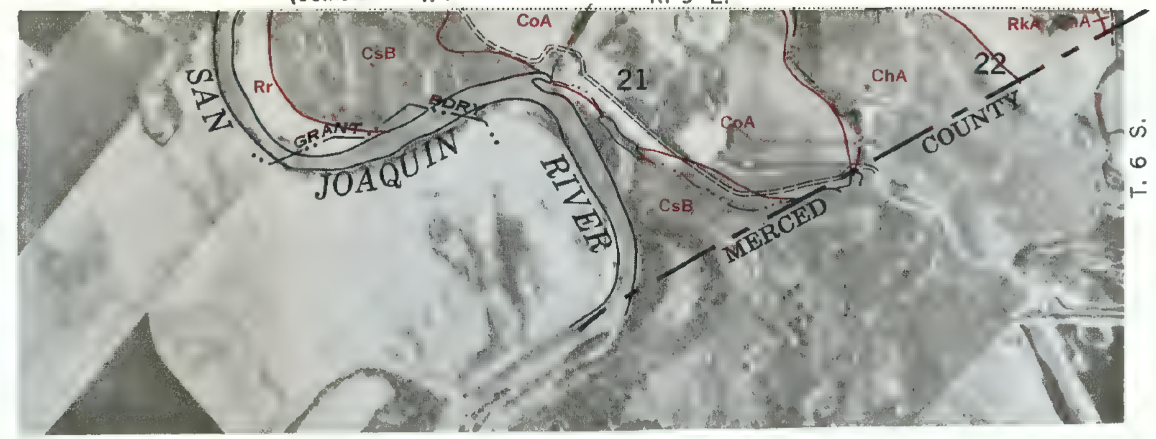
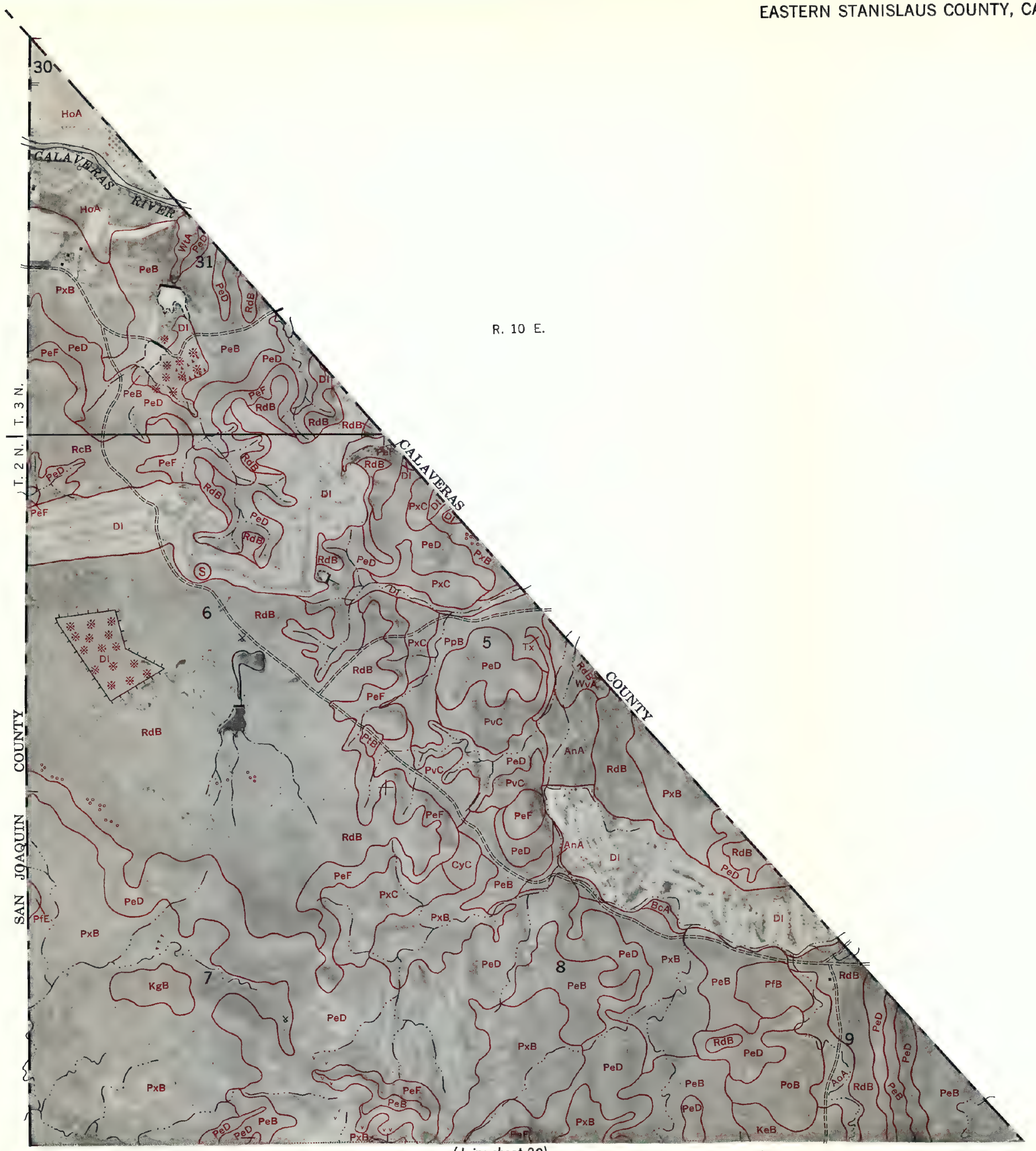
18



0 1/2 1 Mile Scale 1:20 000 0 5000 Feet



(Joins sheet 20)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

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20
(Joins sheet 19)
R. 10 E.
N
T. 2 N.
SAN JOAQUIN COUNTY
CALAVERAS COUNTY
STOCKTON AND COPPEROPOLIS (ABANDONED)
Duck Creek
North Fork
MILTON ROAD
18
17
16
15
19
20
21
22
23
30
29
28
27
26
LIMIT OF DETAILED SOIL SURVEY
0 ½ 1 Mile
Scale 1:20 000
0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 21

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

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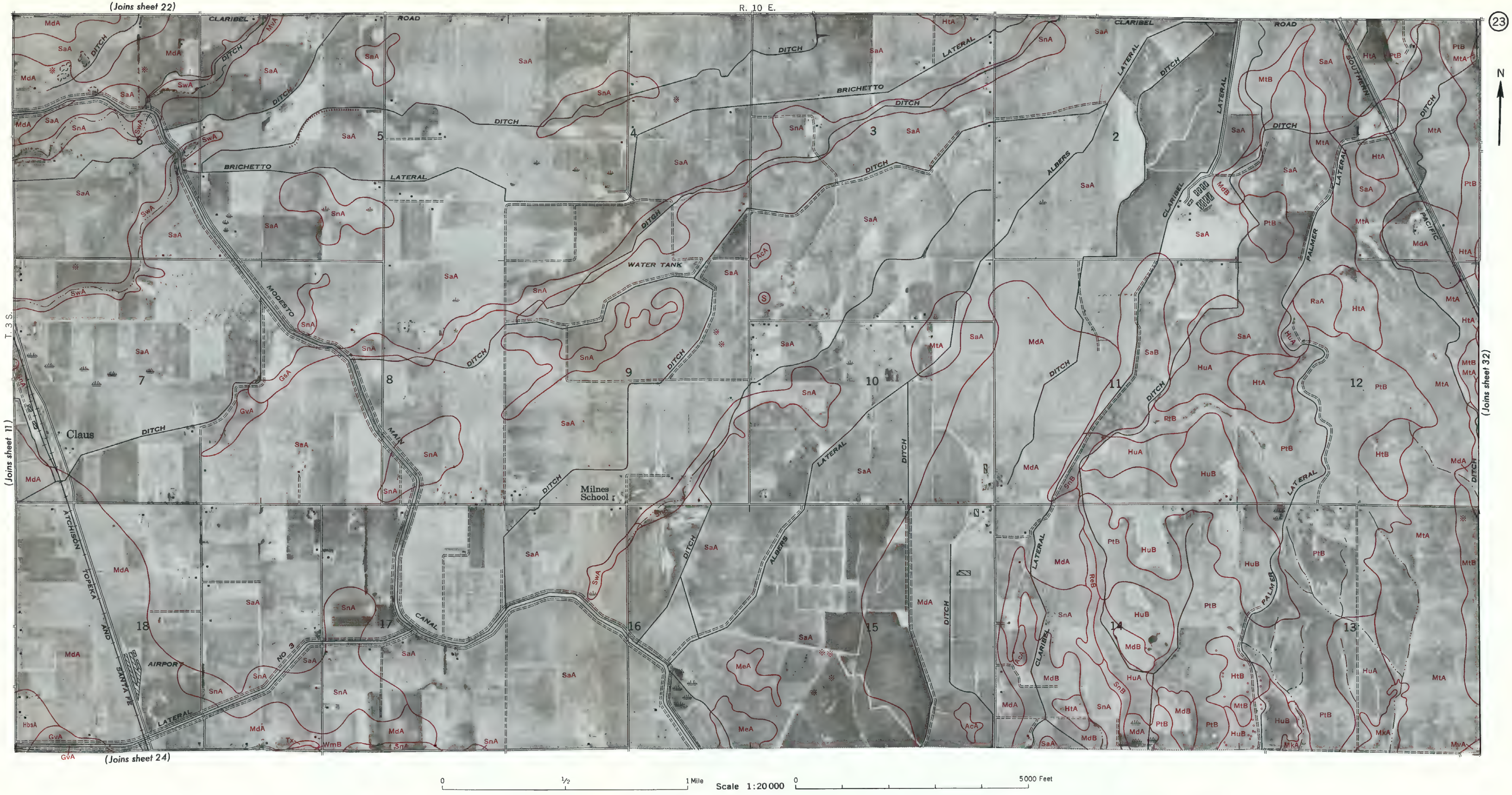
(22)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet



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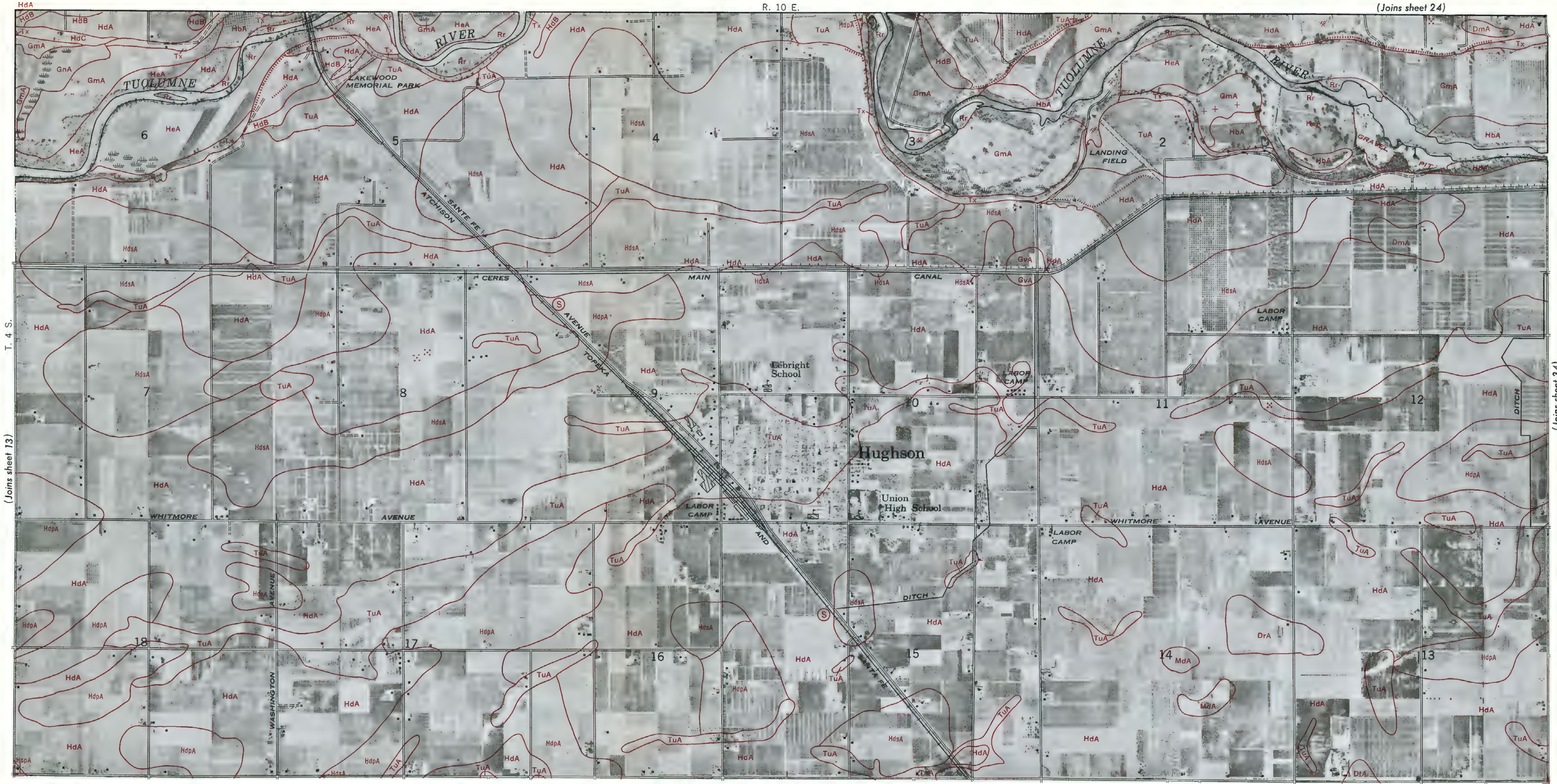
EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 24

(25)



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

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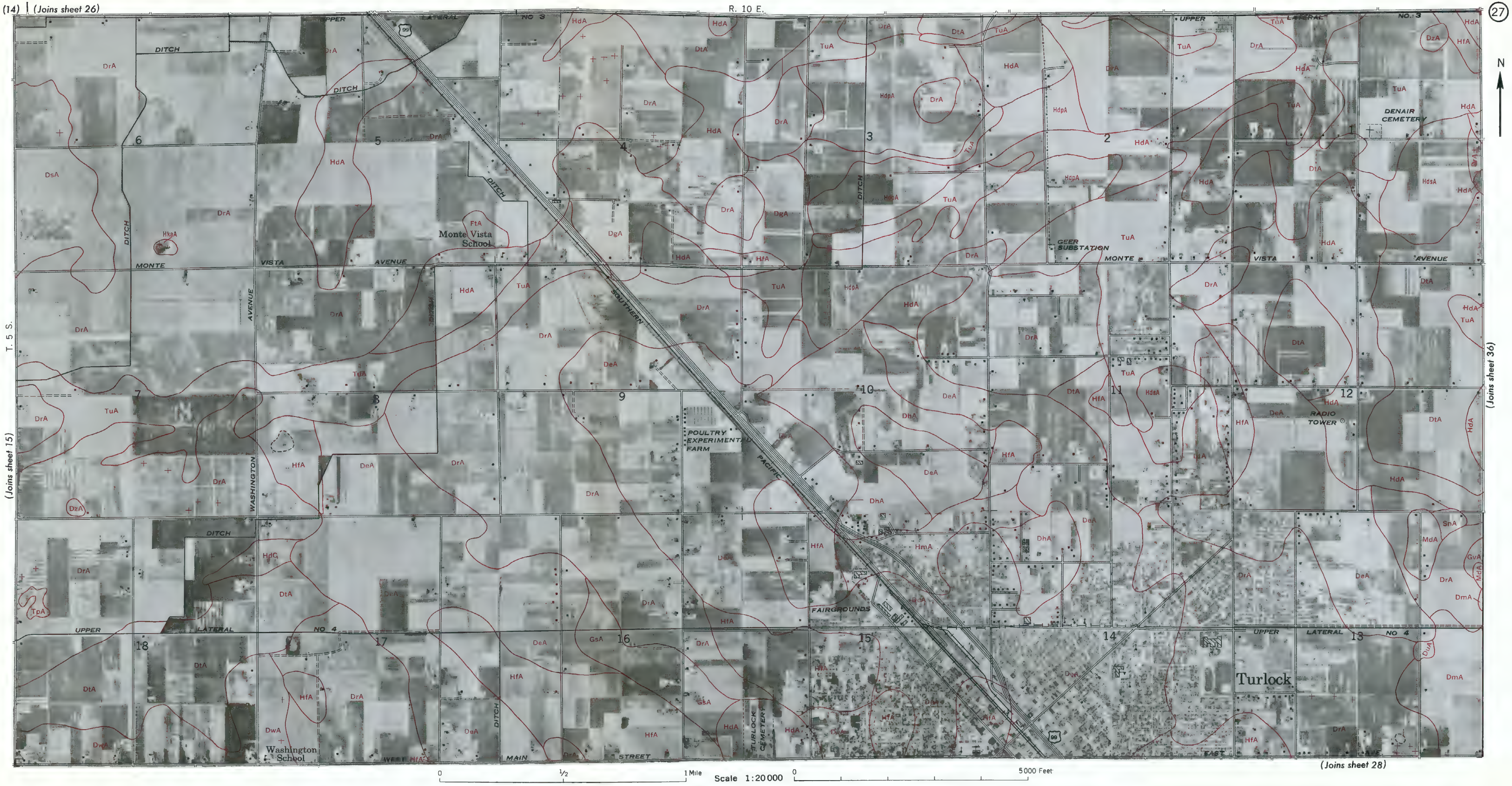
Range, township, and section corners shown on this map are indefinite.


26
(Joins sheet 25)
R. 10 E.
N
T. 4 S.
(Joins sheet 14)
(Joins sheet 35)
(Joins sheet 27)
(36)
Keyes
Union High School
Lowell School
UPPER LATERAL NO 2
UPPER LATERAL NO 2½
WASHINGTON AVENUE
DITCH
KEYES ROAD
SOUTHERN PACIFIC
ATCHISON TOPEKA AND SANTA FE
UPPER LATERAL NO 3
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
0
½
1 Mile
Scale 1:20000
0
5000 Feet



0 ½ 1 Mile
Scale 1:20 000
0 5 000 Feet

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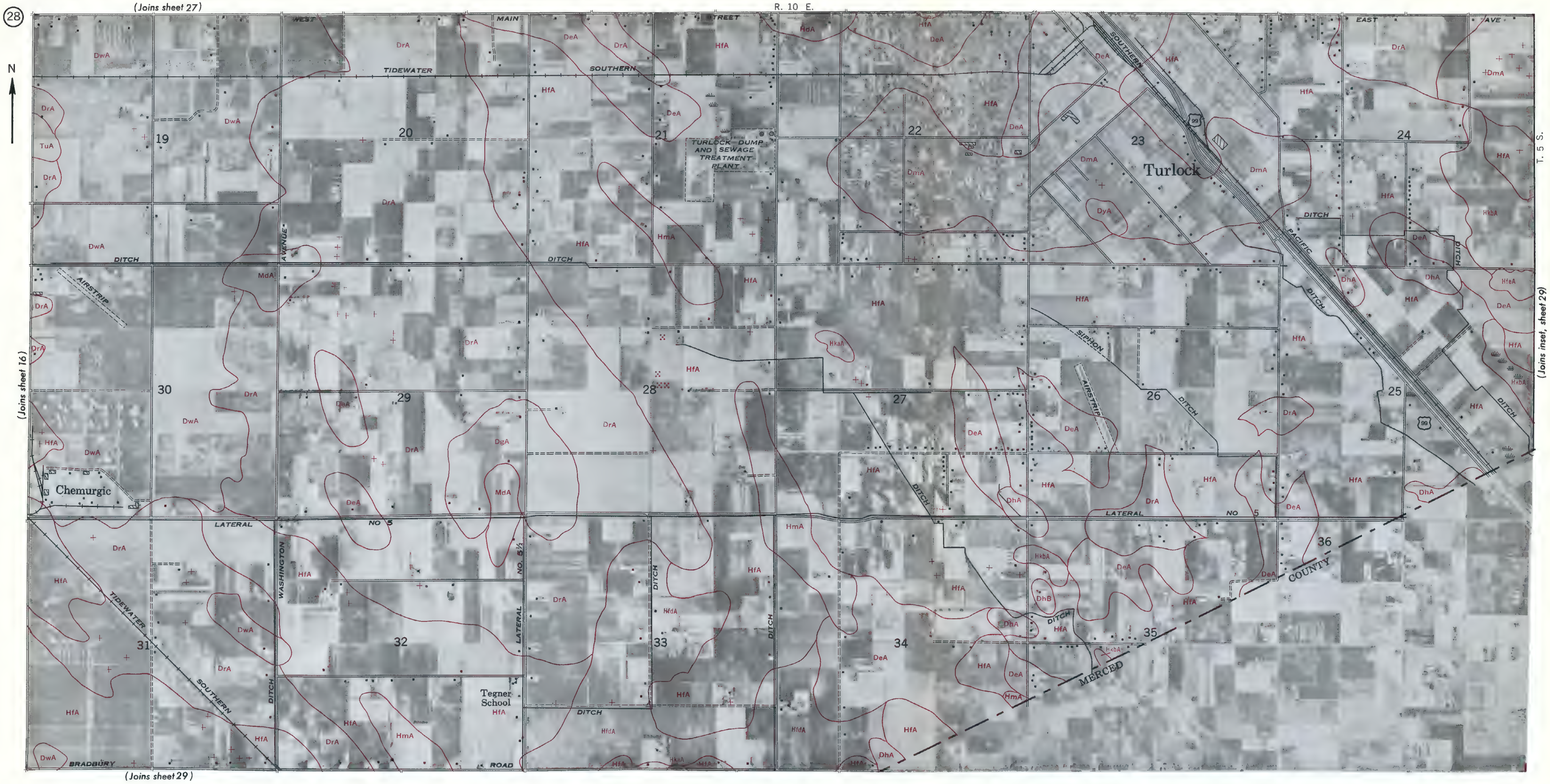

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

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0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 31

(31)

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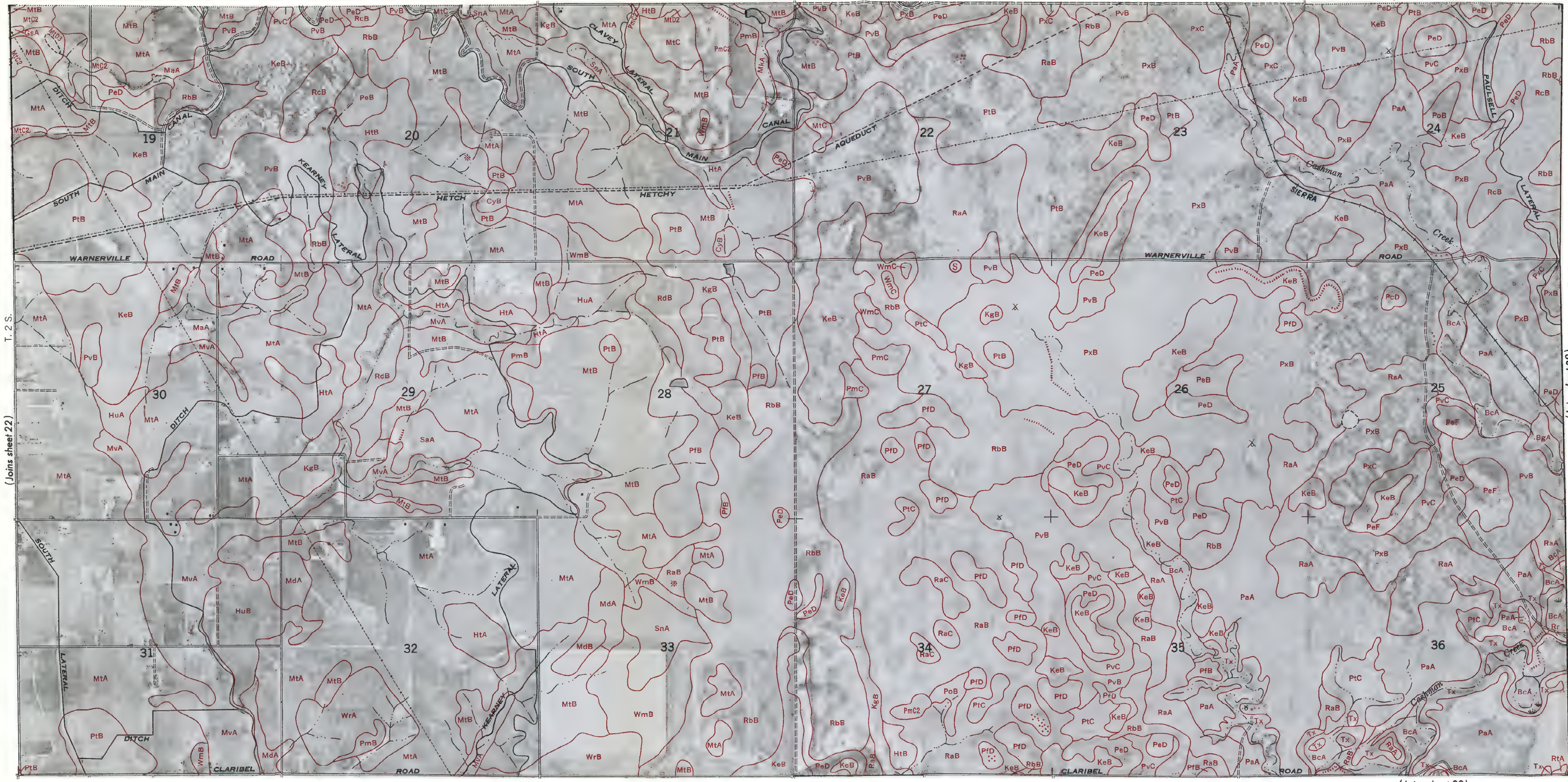
Range, township, and section corners shown on this map are indefinite.

R. 11E.

(Joins sheet 30)

T. 2 S.

(Joins sheet 22)



(Joins sheet 39)

(Joins sheet 32)

Scale 1:20 000

0 1/2 1 Mile

0 5000 Feet

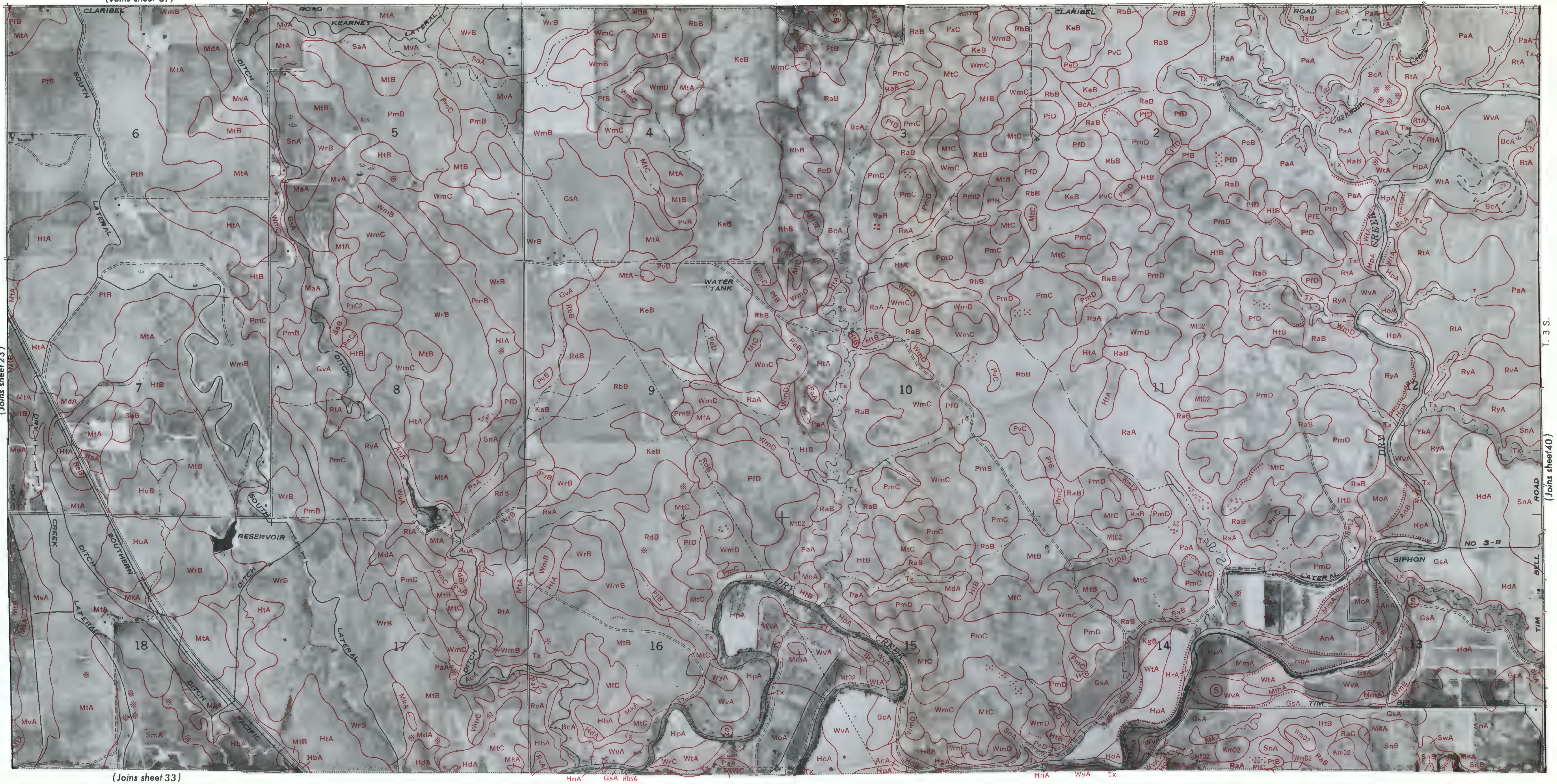
32

(Joins sheet 31)

R. 11 E.

N

(Joins sheet 23)



T. 3 S.

(Joins sheet 40)

(Joins sheet 33)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

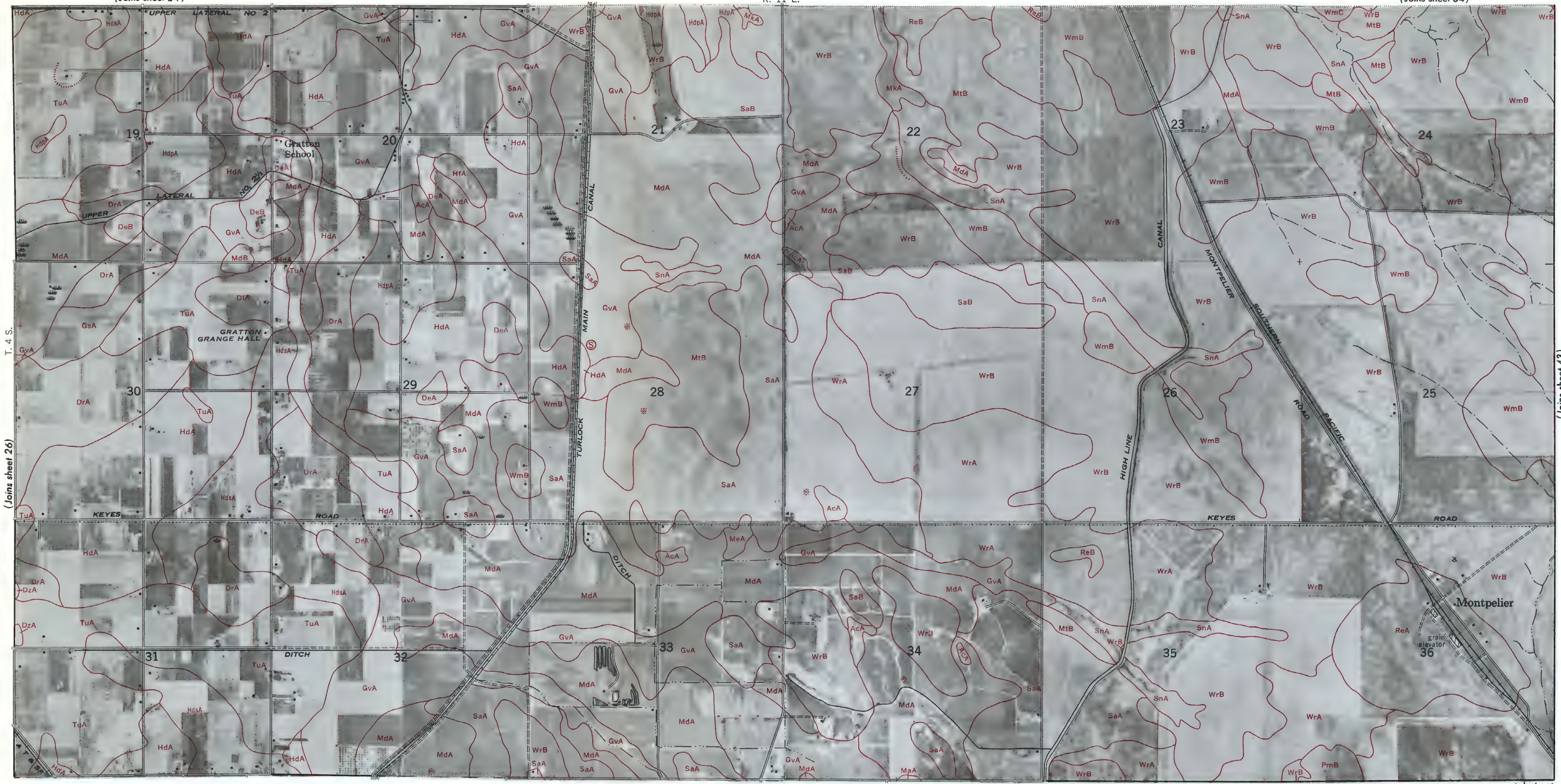
Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


34
(Joins sheet 33)
R. 11 E.
N
(Joins sheet 25)
(Joins sheet 42)
(Joins sheet 35)
T. 4 S.
Hickman
TUOLUMNE
RIVER
LA GRANGE
ROAD
CERES
MAIN
CANAL
DITCH
LANDING
FIELD
TURLOCK
MAIN
CANAL
SOUTHERN
PACIFIC
MONTPELIER
ROAD
WHITMORE
AVENUE
HIGH LINE
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 35

(Joins sheet 34) R. 11 E. (Joins sheet 34) 35



(Joins sheet 36) | (44)

Scale 1:20 000

0 ½ 1 Mile

0 5 000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

R. 11 E.

(Joins sheet 30)

N

R. 12 E.

(Joins sheet 38)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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Range, township, and section corners shown on this map are indefinite.

0 1/2 1 Mile Scale 1:20000 0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 39

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

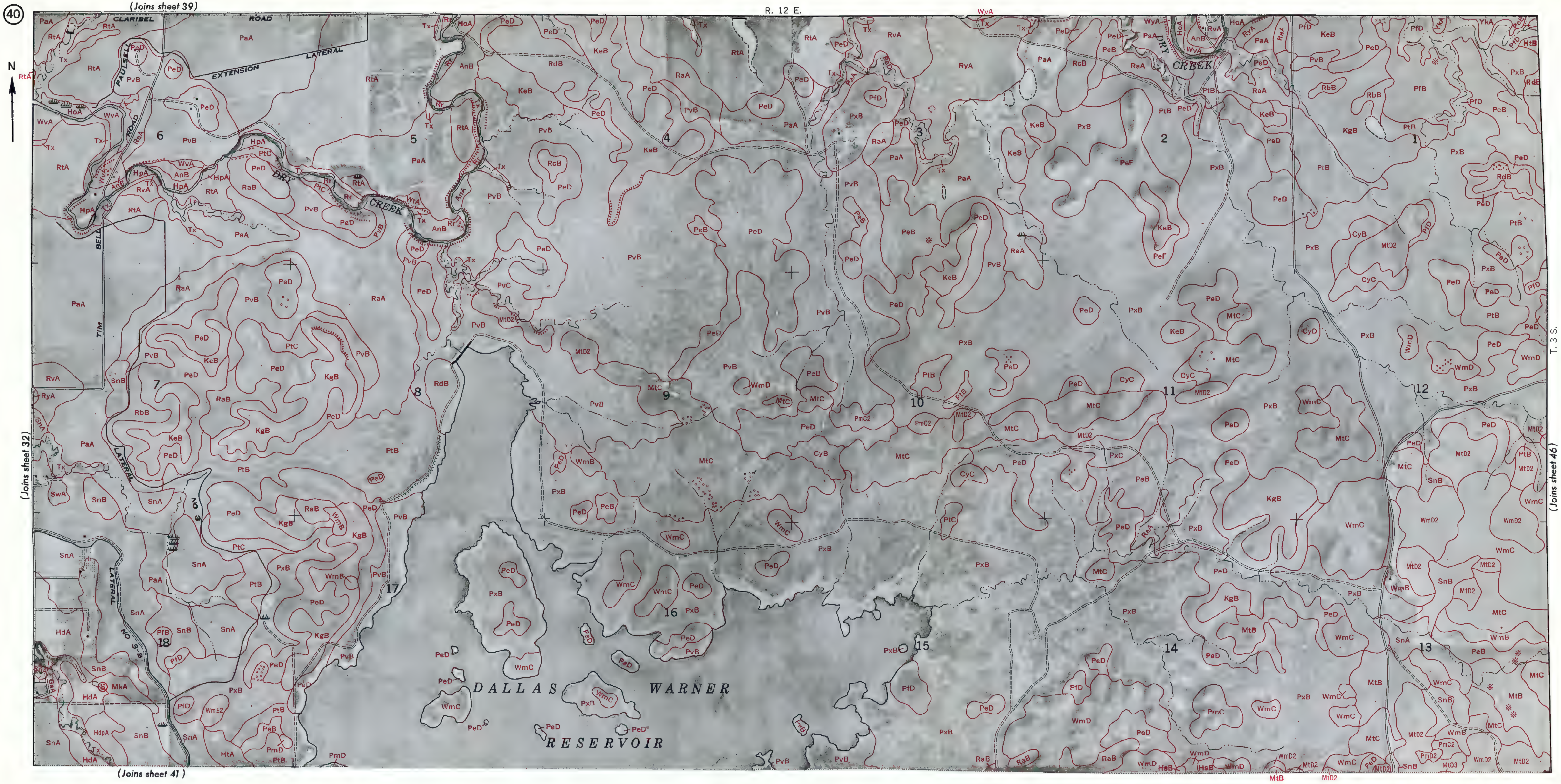
Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 40



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

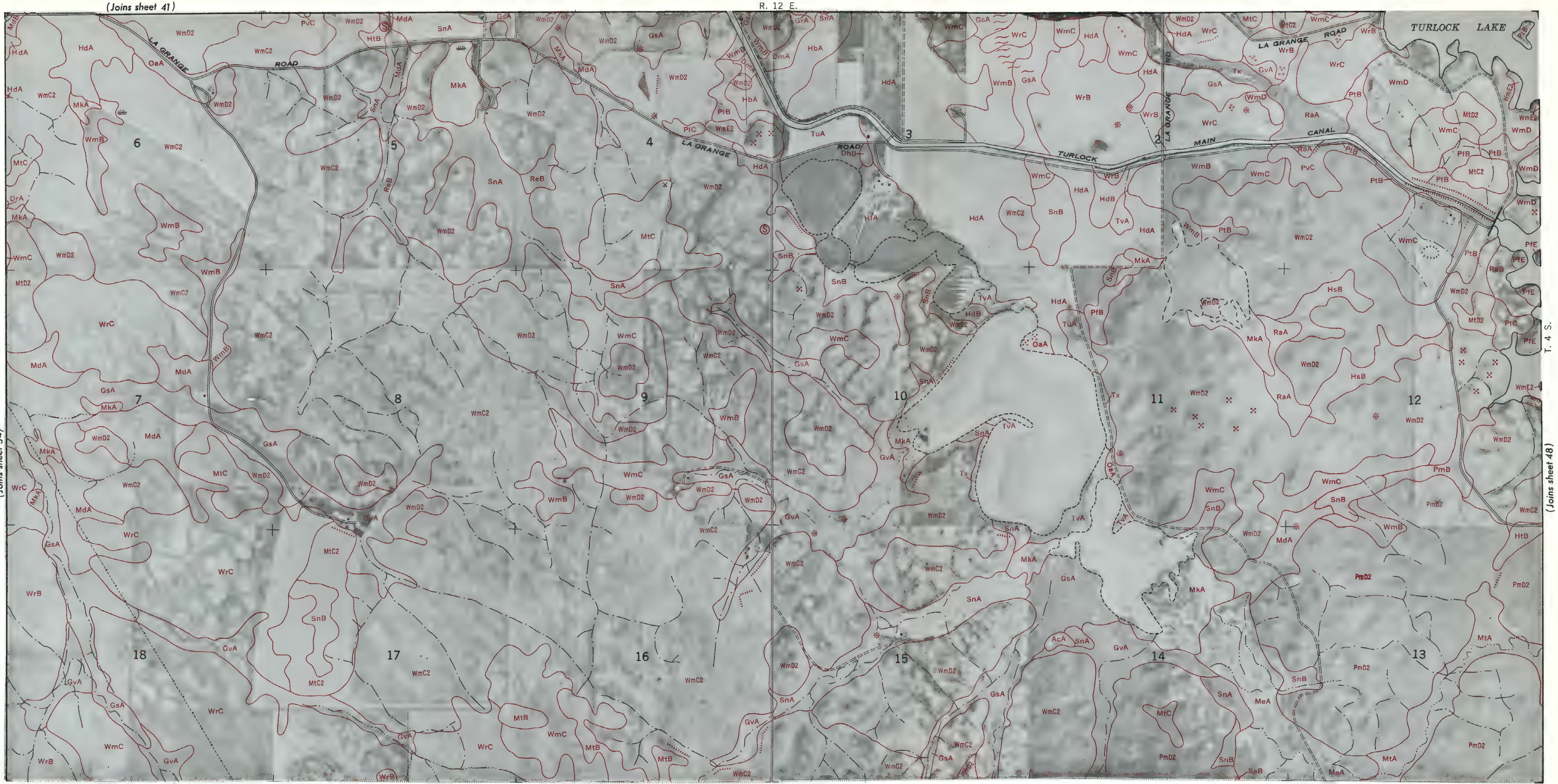
This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

Range, township, and section corners, shown on this map are indefinite.

42

(Joins sheet 41)

R. 12 E.

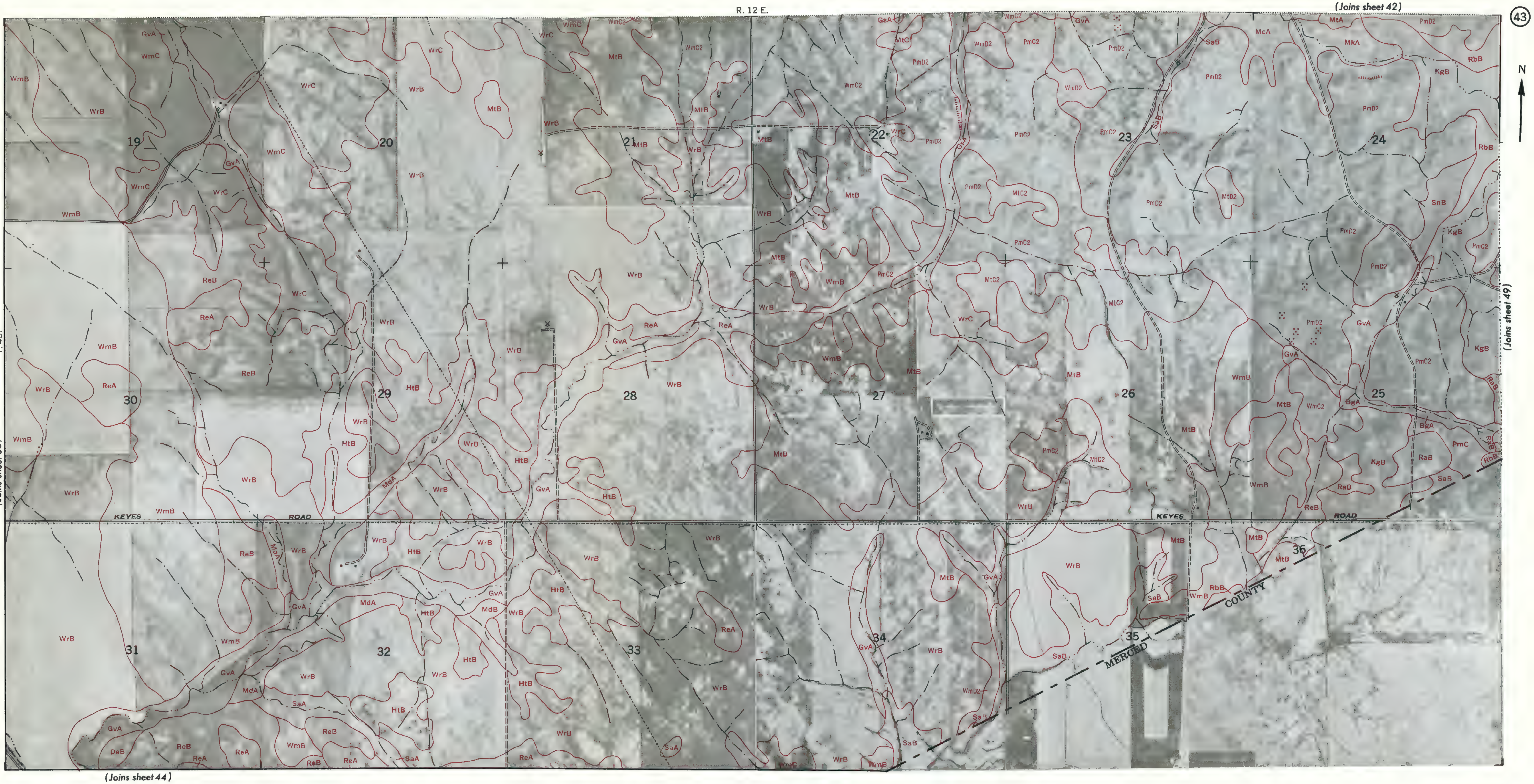


(Joins sheet 43)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

Range, township, and section corners shown on this map are indefinite.



0 1/2 1 Mile Scale 1:20000 0 5000 Feet


44
(35)
(Joins sheet 43)
R.12 E.
N
T.5 S.
(Joins sheet 36)
MONTPELIER ROAD
MONTE VISTA AVENUE
MERCED COUNTY
WrB
ReB
ReA
GvA
DeB
SaA
MtA
MtB
MdA
HdA
WmC
WmB
3
4
5
6
7
8
0
½
1 Mile
Scale 1:20 000
0
5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

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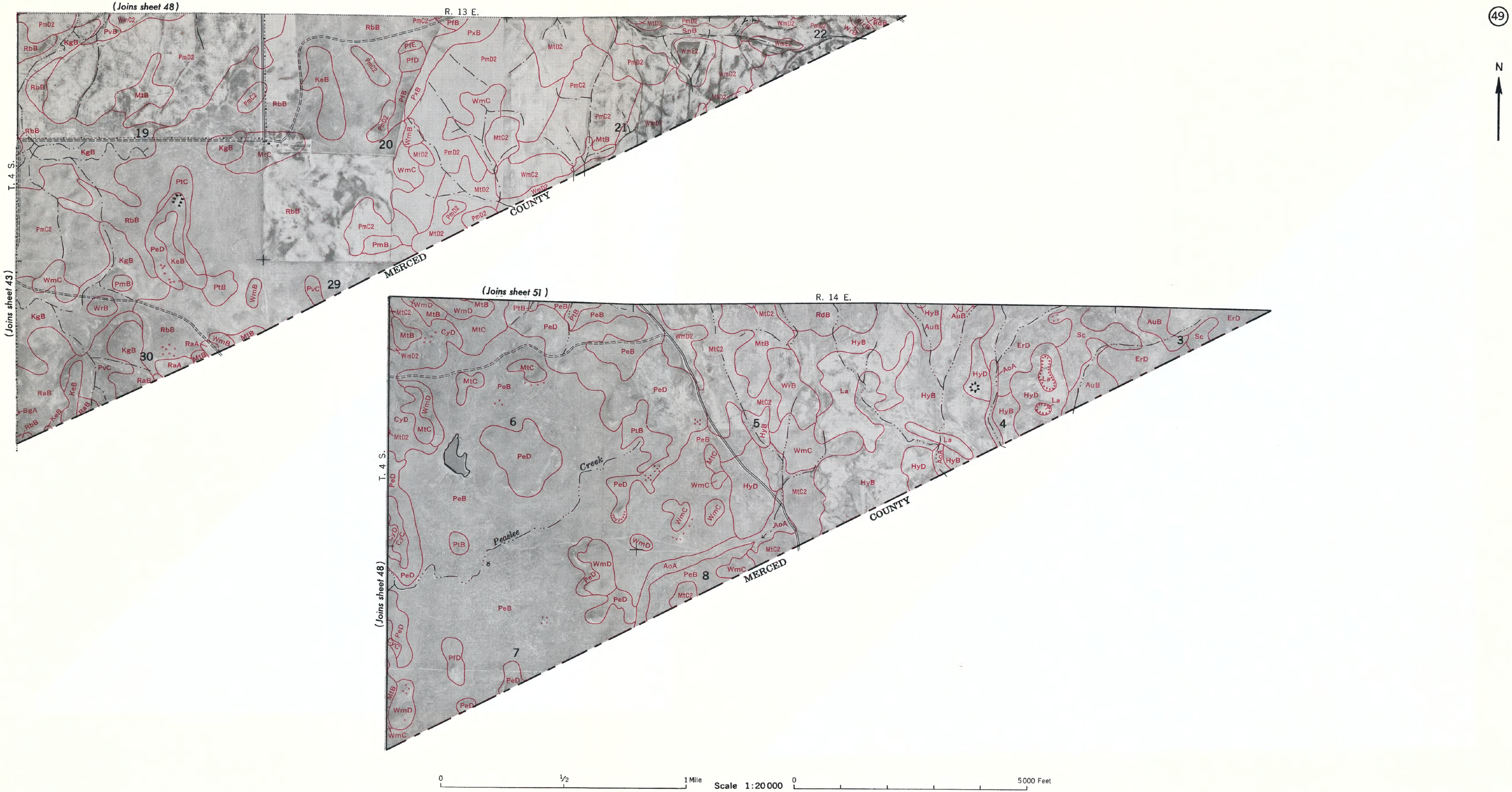
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

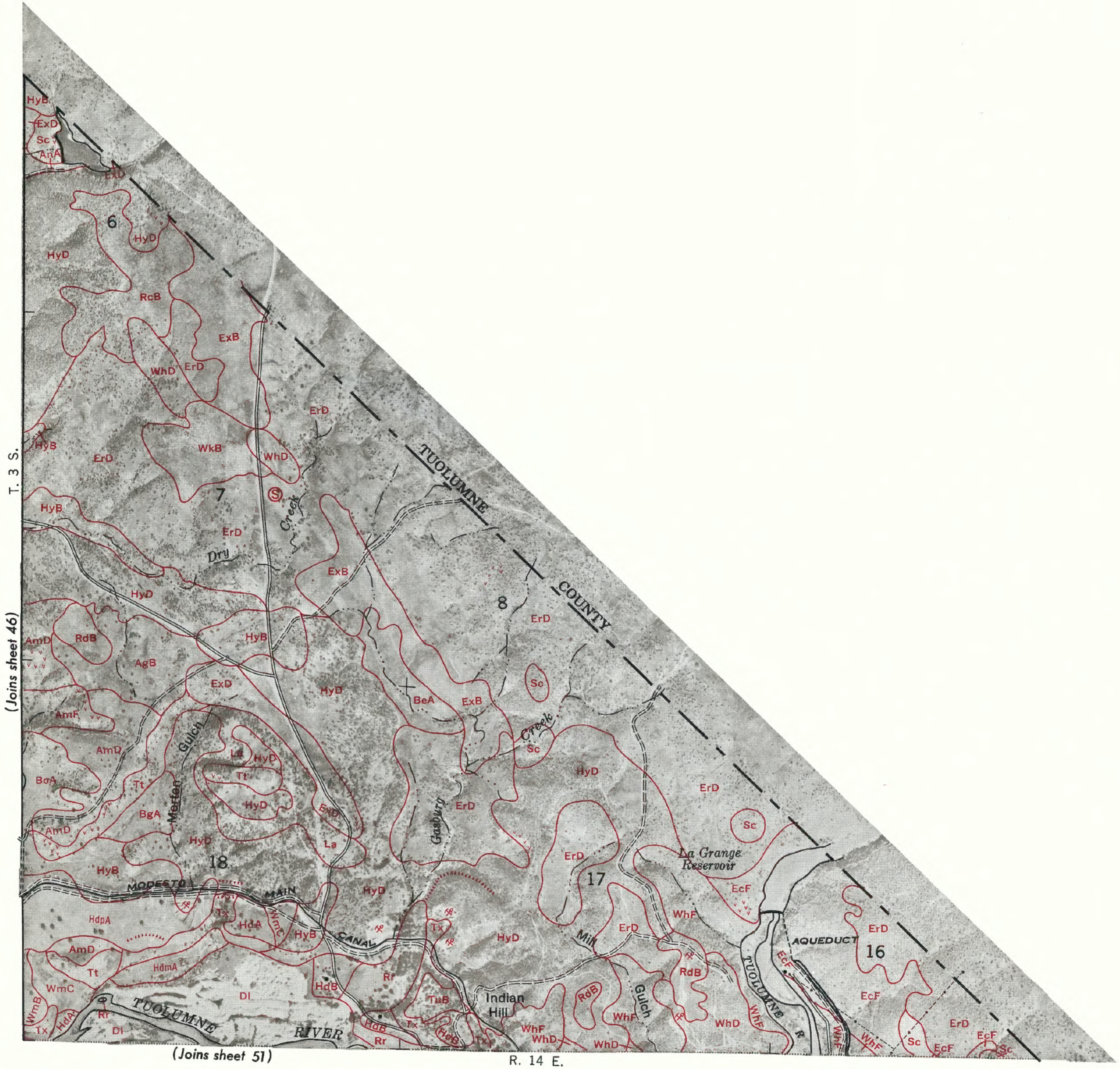


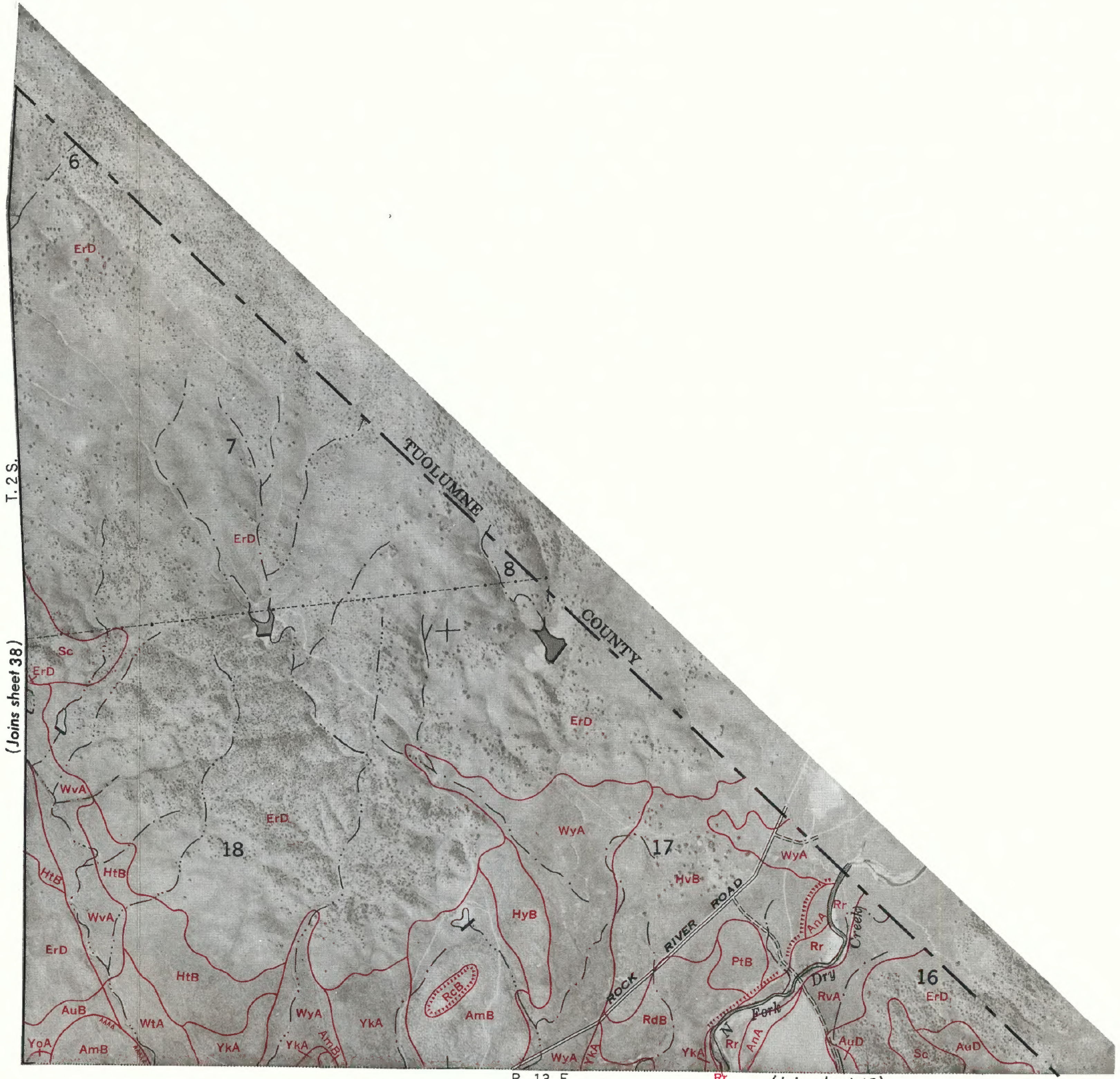
This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

Range, township, and section corners shown on this map are indefinite.

(50)

N





0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

EASTERN STANISLAUS COUNTY, CALIFORNIA - SHEET NUMBER 51

51

N

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1957.

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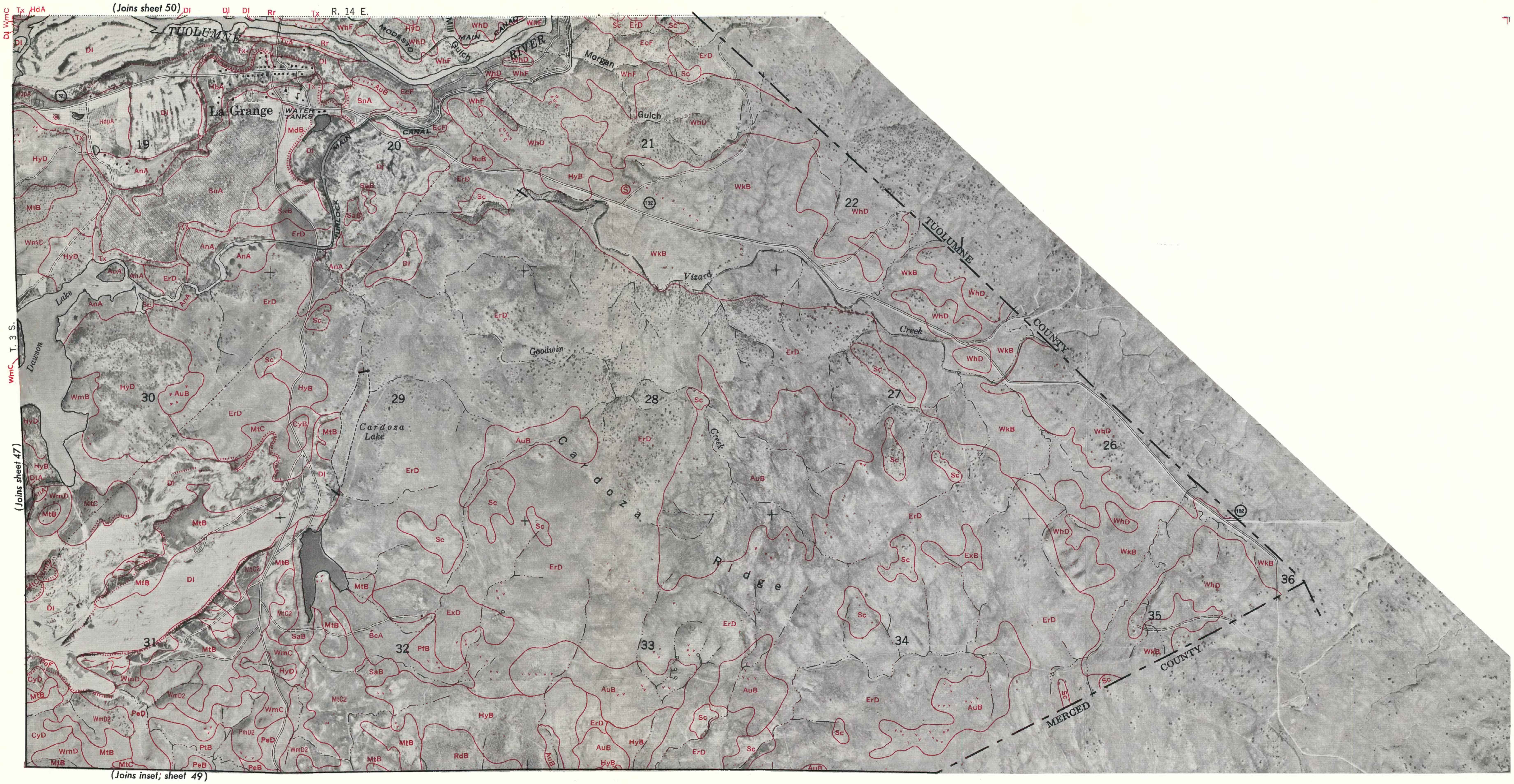

0 ½ 1 Mile Scale 1:20000 0 5000 Feet